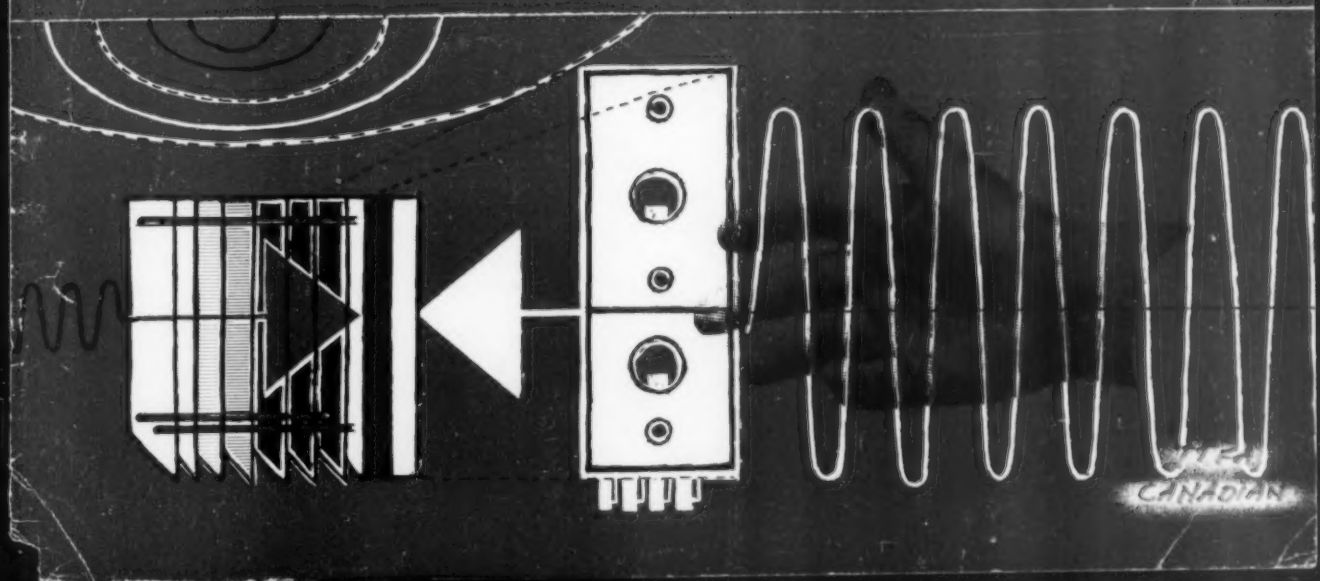
CANADIAN ELECTRONICS ENGINEERING

DECEMBER 1958
A Maclean-Hunter Publication
five dollars a year



Blueprinting the Future...

Day after day, right here in Canada, men with vision and purpose are piecing together minute fragments of the future . . . organizing, correlating, interpreting them . . . ever bringing tomorrow closer to today.

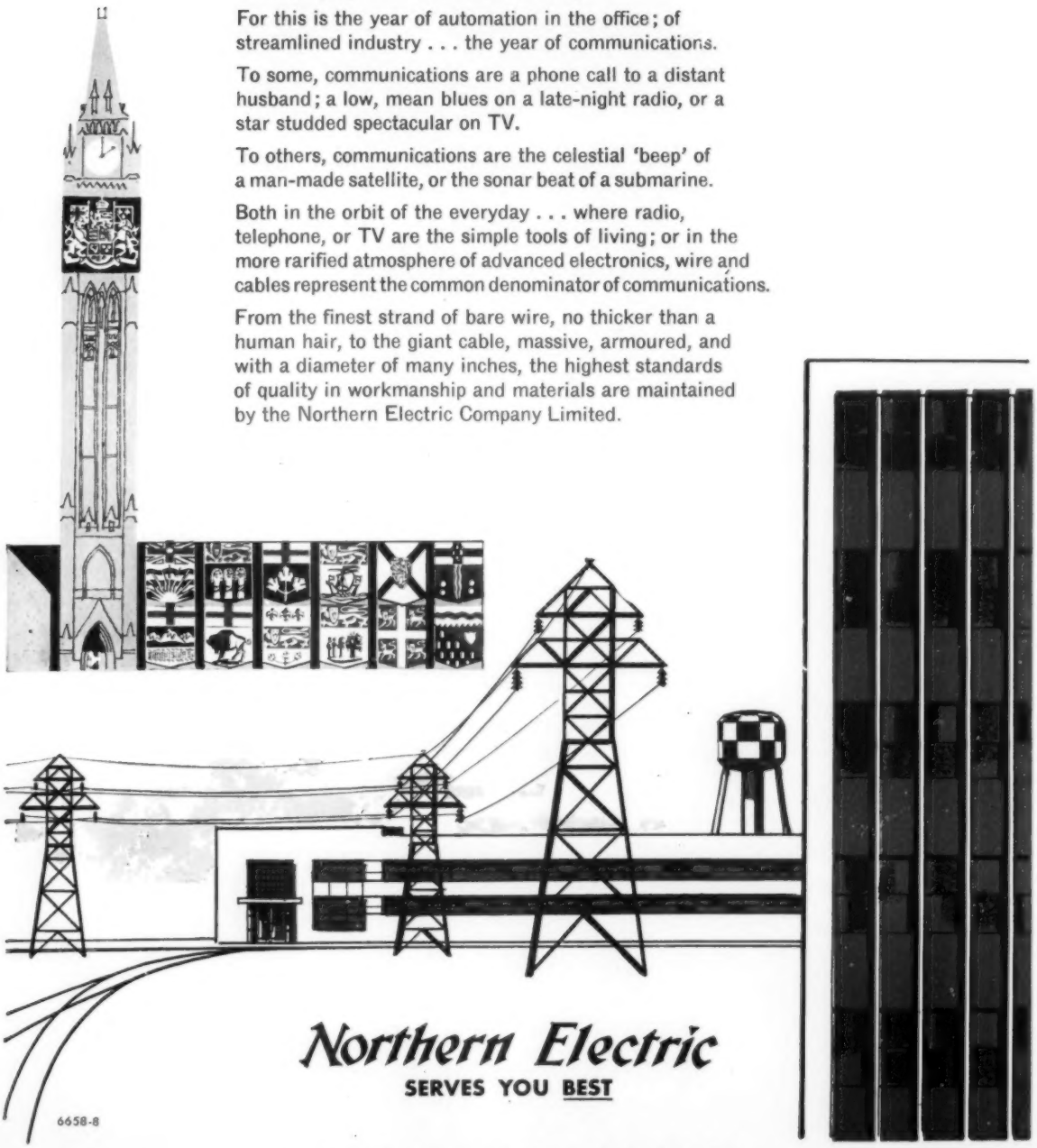
For this is the year of automation in the office; of streamlined industry . . . the year of communications.

To some, communications are a phone call to a distant husband; a low, mean blues on a late-night radio, or a star studded spectacular on TV.

To others, communications are the celestial 'beep' of a man-made satellite, or the sonar beat of a submarine.

Both in the orbit of the everyday . . . where radio, telephone, or TV are the simple tools of living; or in the more rarified atmosphere of advanced electronics, wire and cables represent the common denominator of communications.

From the finest strand of bare wire, no thicker than a human hair, to the giant cable, massive, armoured, and with a diameter of many inches, the highest standards of quality in workmanship and materials are maintained by the Northern Electric Company Limited.



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6658-8

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December 1958

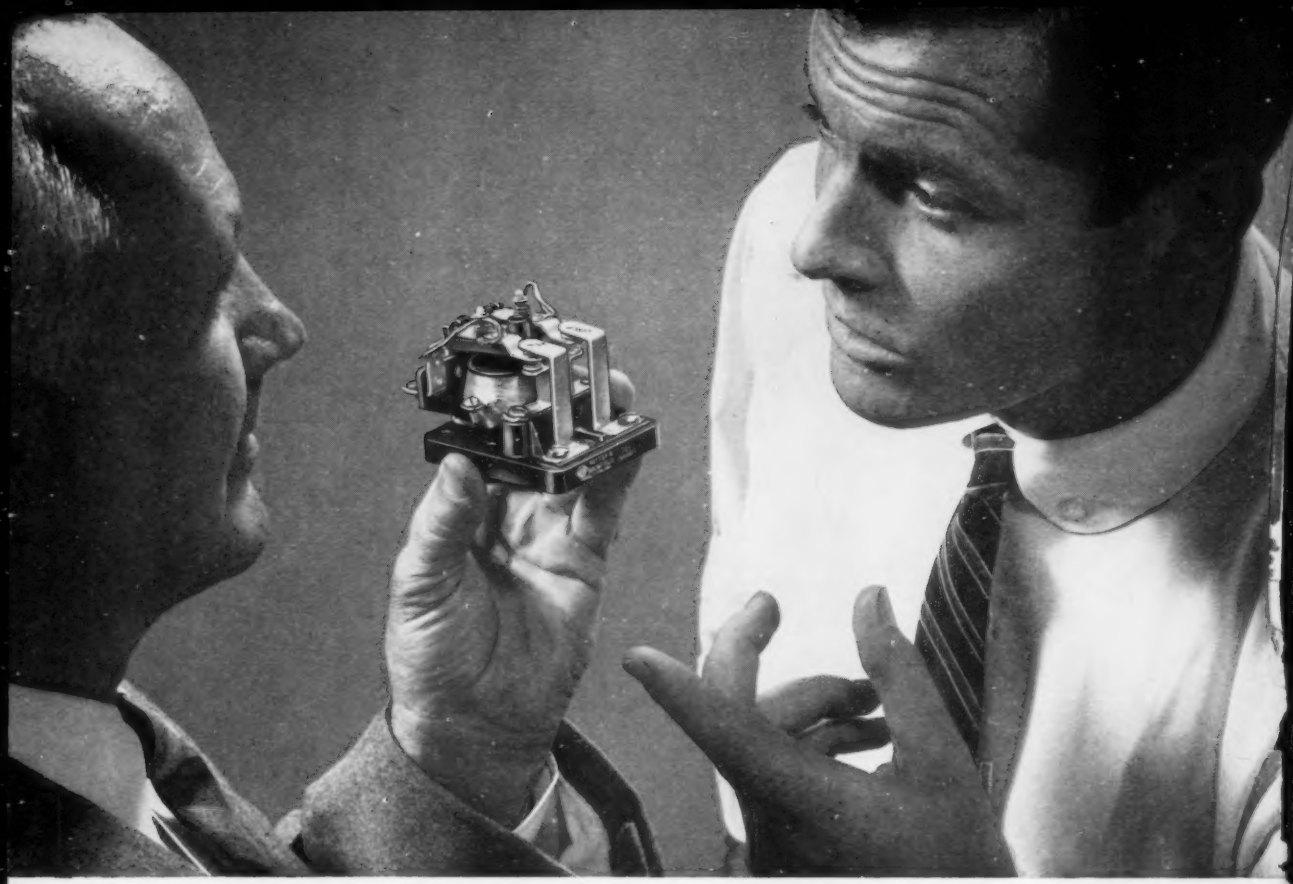
Volume two, number 12

CANADIAN ELECTRONICS ENGINEERING

Departments

*** our cover design**

Artist Frank Newfeld has used both design and color to underline the importance of cooling in transistor power amplifiers



HERE'S WHY P&B's PR POWER RELAY IS PREFERRED

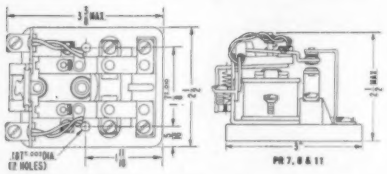
for high current/voltage switching

HEAVY DUTY construction means long-term dependability when switching up to 20 amperes (double break contacts). Here is a ruggedly built relay, packed with high quality features, yet economically priced.

The PR's full floating movable contact carrier, for example, provides excellent contact pressure and ample wipe for self-cleaning contact action. The coil is centrifugally impregnated with top-grade varnish to eliminate moisture traps.

Contact arrangements up to DPDT are available. The PR has been adapted for printed circuitry and heavy duty plug-in applications.

All standard AC actuated PR relays may carry the UL and Canadian Standards Association seals of approval. Write or call for complete information.



GENERAL SPECIFICATIONS:
Breakdown Voltage: 1500 volts rms min. between all elements and ground.
Ambient Temperature: DC: —55° to +85°C.
AC: —55° to +55°C.
Terminals: Heavy duty screw type. Standard printed circuit pins or plug-in on request.
Enclosures: PR dust cover.

CONTACTS:
Arrangements: Up to 2 Form C (DPDT).
Material: 5/16" dia. silver or silver cadmium oxide. (Others available)
Load: Single break: 15 amps; Double break: 20 amps at 115 volts 60 cycle AC resistive.

AUXILIARY CONTACTS:
Arrangements: 1 Form A, B or C.
Material: 3/16" diameter silver
Rating: 5 amps at 115 volts 60 cycle AC resistive.

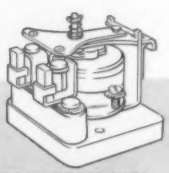
COILS:
Resistance: 64,000 ohms maximum.
Power: 1.8 watts DC; 9.8 volt-amps AC.
Duty: Continuous AC or DC (DC coils will withstand 10 watts at 25°C).
Insulation: Centrifugally impregnated with high quality varnish.
Mountings: 2 holes .187" diameter 1 7/8" o.c.

PR Relays Approved By Underwriters' Laboratories and Canadian Standards Association

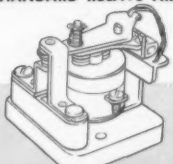
Type	Contact Arrangement*	Type	Contact Arrangement*
PR1AY	SPST-NO	PR5AY	SPDT
PR2AY	SPST-NC	PR7AY	DPST-NO
PR3AY	SPDT-NO-DM	PR8AY	DPST-NC
PR4AY	SPDT-NC-DB	PR11AY	DPDT

These relays are available in any of the following operating voltages: 6, 12, 24, 48, 115, 208, 230, or 440 volts 50/60 cycles AC.
The contacts are rated at: 13 amps, 115 volts AC. 6.5 amps, 230 volts AC. 1 hp for 115 or 230 volt AC motors.
Any relays deviating electrically or physically from these standard models will not carry U/L or CSA approval.
*Read: NO normally open, NC normally closed, DB double break, DM double make.

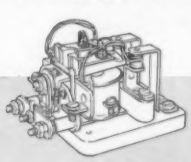
P&B STANDARD RELAYS ARE AVAILABLE AT YOUR LOCAL ELECTRONIC PARTS DISTRIBUTOR



PR RELAY WITH MAGNETIC BLOW-OUTS
Models PR3 and PR7 can be supplied with alnico magnets to suppress arcs on DC loads over 1200 watts.



SINGLE POLE DOUBLE THROW VERSION
PR 5 (SPDT) has all the heavy-duty features of other models in this series.



PR WITH AUXILIARY CONTACTS
All PR models can be equipped with auxilliary contacts in 1 Form A, B, or C arrangements.

amf **POTTER & BRUMFIELD** CANADA LTD.
Guelph, Ontario

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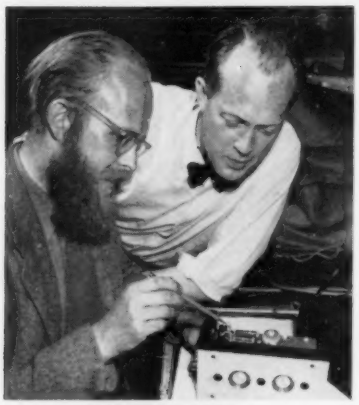

Mace and Blunt

Bertin

Naylor

D. G. W. Mace and **R. N. Blunt** (Low frequency transistor amplifier delivers 60 watts) both joined Canadian Westinghouse Co. Ltd., Hamilton, in 1955 on their arrival from England. Mace has recently returned to the U. K. to pursue post-graduate studies. He has a BSc in electrical engineering from London University, and was previously with Vickers-Armstrong and the BBC. In Hamilton he was a senior engineer in the telecommunications and electronic control engineering departments.

Roger Blunt has worked on guided missile electronics on both sdies of the Atlantic, first with Armstrong-Whitworth Aircraft and then at C.W.Co. He is now developing automatic controls for machine tools. Radio-controlled model aircraft are his chief hobby—he is president of the Hamilton Aero Modelling Club.

Another Englishman who has returned to school, **R. H. Parker** (Successful supervisorship) is now in the final year of the U of T engineering physics course. He has done design and production engineering at Canadian General Electric Co. Ltd. and Aeromagnetic Surveys Ltd.

Mr. Parker received the Higher National Diploma from Regent St. Polytechnic, London, in 1951 and is a member of the Association of Professional Engineers of Ontario.

Leonard Bertin (Electronics' future in nuclear work) is science editor of The Financial Post, Toronto, and author of Atom Harvest (W. H. Freeman & Co., San Francisco), a history of the U. K. atomic energy project.

A Cambridge graduate, after seven years war service in the Royal Artillery, he joined the London Daily Telegraph and served as reporter, foreign correspondent and sub-editor before starting a science department for that paper.

He has visited 30 countries, has seen atom bomb tests in Australia and Hydrogen bomb tests in the Pacific. He came to Canada to join FP in September, 1957.

R. W. Naylor (How audio limiters increase coverage) was connected with various aspects of Canadian General Electric's broadcast engineering program from 1952 to 1958. He had a share in the engineering of about one third of Canada's TV stations and was associated with the all-Canadian design of advanced broadcast transmitters from 250 watts to 50 kilowatts. He is now engaged in the operation of his own engineering and manufacturing firm, Robert Naylor Ltd., and is also chief engineer of Allied Industrial Electronics Ltd.

Mr. Naylor is a Sr. Member of the IRE and a member of the Association of Professional Engineers of Ontario. He holds both BASc and MASc degrees from the University of Toronto.

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News highlights...

USAF orders Canadian equipment . . .

Canadian Westinghouse Company are enjoying considerable success in selling their 4,400 - 5,000 mc Microscatter equipment to the USAF. Now in production are a standard version for use in the establishment and testing of ground control for the Bomarc missile, and a tactical system with 48 voice channel capacity.

Diode prices continue downward trend . . .

Latest example of the continuing trend towards lower prices for semiconductor devices is a major price reduction on its HB silicon diode line, announced by the Semiconductor Division, Hoffman Electronics Corp. The price reduction, from $1.05 to 44 cents per unit in lots up to 1,000, is expected to make possible the use of silicon diodes in commercial applications previously restricted to germanium units because of cost considerations.

Miniaturization efforts to be rewarded . . .

Entries are now being received for the 1958 Miniaturization Award (MA 58), sponsored by Miniature Precision Bearings, Inc. The award will be presented in New York City on March 22, 1959, for the best example of miniaturization developed during 1958. Details can be obtained from the MA 58 Committee, Box 604, Keene, N.H.

Better, cheaper transistors on the way . . .

Production economies for the transistor industry, as well as a superior product, are expected to result from work now being done by Nuclear Science and Engineering Corporation, Pittsburgh. NSEC have a USAF contract for the development of a low-level radioactivity counter which will detect the presence of as little as one part per billion of impurities in silicon.

Canadian instrument shows its paces . . .

The Airborne Profile Recorder (APR) designed and built by Canadian Applied Research Ltd. has successfully completed its operational tests in the aircraft carrying out the new U. S. Air Force program of bringing the world's geography up to date, with an average accuracy of $\pm$ 10 feet. The APR is now in full production at the firm's Toronto plant.

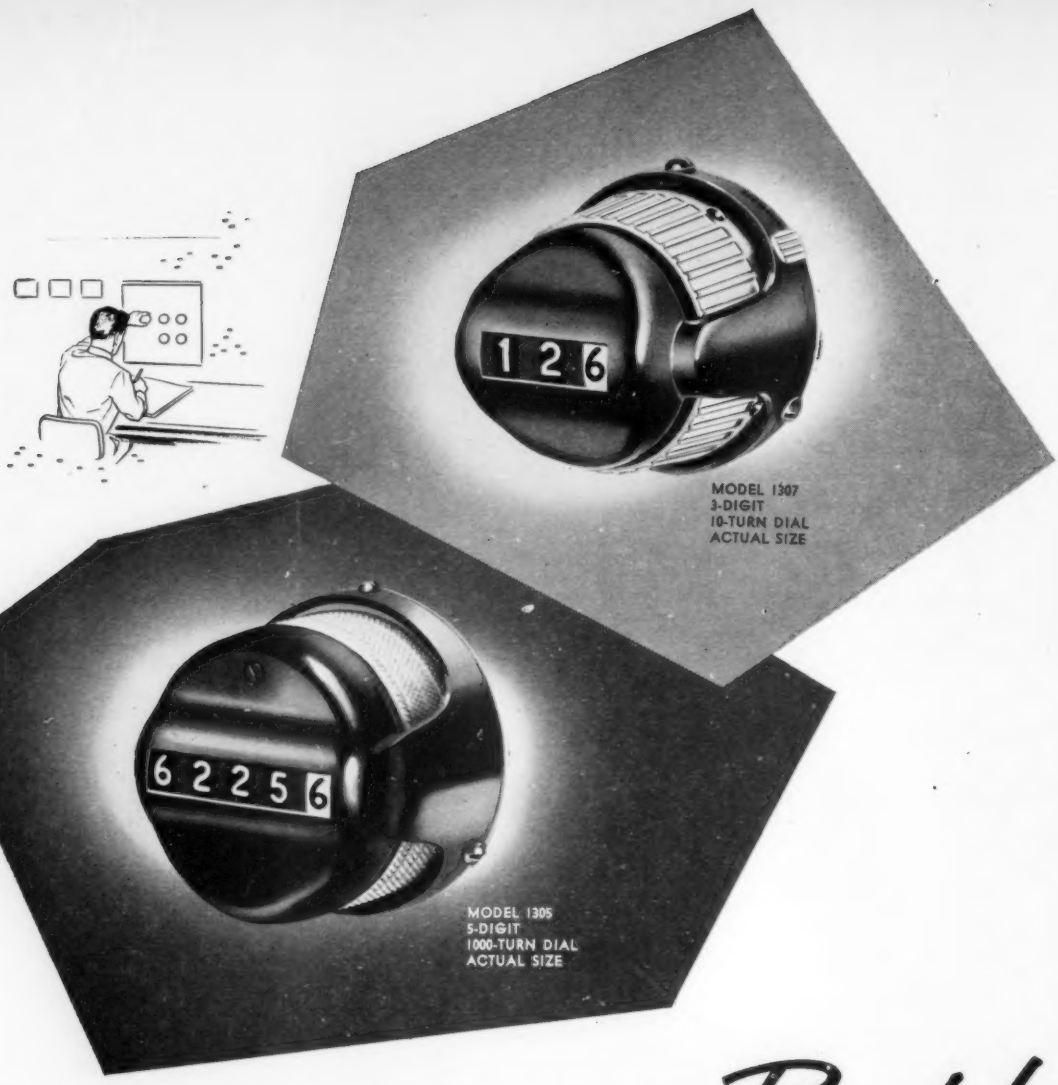
CBC to extend northern service . . .

The CBC is acquiring radio stations to extend its broadcasting service to Canada's 32,000 northern population. In addition to taking over existing stations and installing relay transmitters, preliminary planning is under way on a $1 million short wave transmitter for Vancouver.

EIA: Robinson describes "simultaneous world" . . .

"The tremendous impact that electronics has already made on world conditions; and the even greater changes which can be expected, means that we are rapidly approaching a 'simultaneous world'," said Ron M. Robinson, EIA president, when he addressed the Components Division recently.

This simultaneous world of communication, explained Mr. Robinson, was one in which communication around the globe was so rapid and so complete that the information conveyed by electronic means would reach all peoples simultaneously and without censorship. But this means everybody would have access to news events as they happened, by electronic oral and visual means, and ignorance and misunderstanding could be averted.



GIVE A MAN A DIAL HE CAN *Read!*

REDUCE costly forced-fast-reading errors. Give a man a dial he can read quickly, accurately . . . Borg Direct-Reading Microdials. Borg's inline digital presentation provides the greatest accuracy of perception when fast dial reading is required. Numbers are viewed through a one-piece, curved, sealed window. Available in 3-digit 10-turn models, 4-digit 100-turn models and 5-digit 1,000-turn models.

ALSO AVAILABLE . . . Borg Concentric Scale Microdials to indicate the position of any multi-turn device of 10-turns or less. Write for complete data on all Borg Microdials.

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Canadian broadcasting policy rests in capable hands

Canada's new broadcasting act was proclaimed November 11. The names of the Board of Broadcast Governors were announced on the same day.

Chairman of the board is **Dr. Andrew Stewart,** president of the University of Alberta. Dr. Stewart has also served as chairman of the Royal Commission on Price Spreads and as a member of the Royal Commission on Economic Prospects.

With him as full-time members of the BBG are two former writers and newspaper editors. **Roger Duhamel,** of Montreal, once an editor of Le Canada and La Patrie and now professor of French and English literature at the University of Montreal, is named vice-chairman.

Carlyle Allison, editor-in-chief of the Winnipeg Tribune also becomes a permanent member.

J. A. Ouimet, general manager of the CBC, has been named president of the corporation and head of the new CBC board of directors. Vice-president is **Ernest Bushnell,** assistant manager since 1953. Each retain their former titles in the new set-up for the corporation.

Other members of the two boards represent a broad cross-section of Canadian life.

New IRE Canadian Region director

At its meeting on November 18, 1958, the board of directors of the Institute of Radio Engineers announced the election of **A. P. H. Barclay,** of Philips Electronics Industries Limited, Toronto, as director of its Canadian Region.

Mr. Barclay was born in Glasgow, Scotland, in 1913. He received a BA degree in chemistry and physics from McMaster University in 1935, and his MSc from Cornell University in 1936.

Previously with Canadian Westinghouse Co. Ltd., Northern Electric Co. Ltd. and Research Enterprises Ltd., Mr. Barclay joined the Philips enterprises in Canada after the war. He has served successively as chief engineer of the Electronic Tube division, government projects officer, director of engineering, Professional Equipment division and general manager, engineering and manufacturing of this division, the position he currently occupies.

Mr. Barclay is a registered professional engineer and a senior member of the IRE. He served as chairman of the Toronto Section in 1956, as a member of the IRE Canadian Convention Committee in 1956-1958 and as chairman of its Technical Program Committee in 1958. He is associated with the work of the Canadian Radio Technical Planning Board as chairman of its Microwave Committee. As a member of the Electronics Division Committee, he also takes an active part in the Electronic Industries Association.

Barclay

Campbell

Westinghouse appoints executive v-p

The election of **John D. Campbell** to the newly created post of executive vice-president of the Canadian Westinghouse Company, Hamilton, has recently been announced.

Mr. Campbell joined Westinghouse in 1934 and held manufacturing and sales posts before serving in the Royal Canadian Ordnance Corps.

Upon his return from overseas he held executive positions in the company's appliance and electronics operations. He was largely responsible for the establishment and growth of the firm's electronics division at Hamilton and of the coast-to-coast Canadian Westinghouse Supply Company.

Mr. Campbell was appointed general manager of the company's consumer products group in 1954 and became a vice-president in 1956. As executive vice-president he will have general responsibility for all the firm's operating groups.

E. Paul Zimmerman succeeds Mr. Campbell as general manager of the consumer products group.

New general manager for Lenkurt

It is announced that **C. W. Hunter** will become vice-president and general manager of Lenkurt Electric Co. of Canada Ltd., Burnaby, B.C., on January 1, 1959.

He will succeed **William H. Heflin,** who has been named general manager of the commercial products division of Lenkurt Electric Co., Inc., San Carlos, California. Mr. Hunter will serve as assistant general manager of the Burnaby operation until taking over his new duties in January.

Joining Lenkurt in 1952, he was the company's first sales engineer in Canada, and has been commercial manager since 1956. During this period the firm has quadrupled in size, until today it is a full-scale manufacturing and field engineering operation.

A native of Minnedosa, Man., Mr. Hunter graduated from the University of Manitoba in electrical engineering, and served as a signals officer in the RCAF during World War II.

He later spent seven years in communications with the Canadian Pacific Railway, and was a district engineer prior to going to Lenkurt Electric.

Hunter

Ashdown

G/C Ashdown joins TMC (Canada) Ltd.

Mr. D. V. Carroll, president and managing director of TMC (Canada) Limited, has announced the appointment of **Group Captain H. C. Ashdown,** recently retired from the Royal Canadian Air Force, as vice-president, sales.

Group Captain Ashdown has many years' experience in the telecommunications field and has held many important posts in the RCAF in the communications field. These included Commanding Officer of the Training Establishment at Clinton, Ontario, and until his retirement, Director of Radio Warfare at RCAF Headquarters, Ottawa.

CAE adds to Western Division executive

Group Captain Arnold H. Mielke, recently Director of Material Procurement at RCAF Headquarters, has been appointed vice-president of the Western Division of Canadian Aviation Electronics Ltd., Montreal, with headquarters in Winnipeg.

G/C Mielke, a native of Pembroke, Ontario, is a veteran of the RCAF and has served in many locations and duties. Among these have been Staff

(Continued on page 39)

The new E90F is a Special Quality* sharp cut-off pentode designed as a long life replacement for the 6BH6 and 6661. The tube is completely shock and vibration resistant and will maintain its emission after long periods of cut-off operation. It is recommended for mobile radio and industrial use wherever rugged, close tolerance RF pentodes are required.

The E90F has a life exceeding 10 thousand hours when the heater is kept within tolerances of ± 5%. Write for further details and applications.

**Rogers Special Quality tubes were developed for application where dependability is of vital importance. They are finding more and more use in all types of professional equipment. Specify Rogers tubes.*

ROGERS

electronic tubes & components

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★ Rogers Electronic Tubes are sold through Canada's Independent Electronic Parts Distributors

Ontario Hydro installs new data processing system

The first large-scale electronic data processing system to be placed in operation by a Canadian electrical utility was inaugurated last month by Ontario Hydro chairman James S. Duncan.

Located at the Commission's head office in Toronto, the complex of machines, centred on a Remington-Rand Univac II computer, is the focal point of an integrated province-wide system that will eventually be connected to nine regional offices and more than 100 rural offices throughout Ontario.

When in full operation, there will be 13,000 line-miles of teletype over Hydro's 250,000-square mile operational area hooking up these offices to the central location.

In order to meet Hydro's special problems, it was necessary to co-operate with the suppliers (Bell Telephone, Northern Electric, C.N. Telegraphs, etc.) in modifying existing machines, and in designing several new pieces of equipment to serve as components of the communications network.

Among these were a high-speed sorter that will sort and consolidate data received by teletype at about four times normal commercial speed; an "automatic area selector" that will constantly search area office communication lines and start transmission of punched tape on a selective basis; and modifications to such equipment as adding-punching machines and teletype receivers.

Barvic represent Pye in West

Barvic Engineering Ltd., 909 Beach Avenue, Vancouver 1, have been appointed Western Canada agents for Pye Canada Ltd.

As well as maintaining a complete sales and service staff in Vancouver, Barvic have offices in Edmonton.

Collins flight control gains wide acceptance

Collins Radio Company, celebrating their 25th anniversary this year, state that their integrated flight systems and automatic pilots have been widely adopted by major world airlines and air forces.

Recently the RCAF specified the Collins FD-105 integrated flight system and AP-101E automatic pilot for fitment to the CC-109 transport (Canadair model CL-66B). A contract has been placed for this equipment for the CC-109s now in production at Canadair Ltd.

This new order follows purchases by TCA of the FD-104/AP-101E system for Viscounts, FD-105/AP-103 for Vanguards and FD-105 for the DC-8; by Quebecair of FD-104 for their Friendship; by the RCAF of FD-105 for the CC-106 (Canadair model CL-44) long range transports and general purpose ground simulators.

Westinghouse scatter station moved to Picton

Canadian Westinghouse Company's Electronics Division has erected a complete Microscatter communications repeater station at Sugar Point, near Picton, Ont. The other end of the link is located in the West-end plant of Canadian Westinghouse in Hamilton, the almost completely over-water signal path being 130 miles.

The equipment housed in the trailer at Sugar Point is in its second year of continuous testing, having previously been used for over a year in a Hamilton to Kinmount, Ont., test link.

This is the first time in Canada that tropospheric Microscatter has been tested both over a water and a land link in the same area, so that comparative data can be obtained.

Two companies open new Montreal buildings

Aeromotive Engineering Products, sales agents and distributors for a number of American and European manufacturing firms, have recently completed a new building on the outskirts of Montreal. The new premises, located at 147 Hymus Blvd., Pointe Claire, Que., include offices and a warehouse.

Canadian Admiral Corporation Ltd., Port Credit, Ont., opened a new factory sales branch building in Montreal last month, located at 5800 Ferrier St., Town of Mount Royal.

Masco named distributor by J. R. Longstaffe Co.

Masco Electric Co. Ltd., Toronto, with branches in Hamilton, London and Oshawa, have been appointed as a Struthers-Dunn stocking distributor by J. R. Longstaffe Co. Ltd.

A complete line of industrial type relays will be available for immediate delivery from this new distributor.

New reps. for U. S. companies

Lake Engineering Co. Ltd., Scarborough, Ont. has been named Canadian representative for Transistor Electronics Corp. (panel indicator lights, coils and test equipment for computers).

Julie Research Laboratories Inc. announce that their products will be marketed exclusively in Canada by Philips Electronics Industries Ltd., Toronto (precision laboratory equipment and encapsulated resistors).

Antenna Specialists Company, manufacturers of automotive and communications antennas and accessories have appointed A. T. R. Armstrong Ltd., Toronto, as representatives for Canada except British Columbia.

Tele-Radio Systems Ltd., Toronto, have been made Canadian representatives for the Communications Division of Hallamore Electronics Co. (E-type negative impedance repeaters and repeater test sets); also for Radio Specialists Co. (450 mc fm walkie-talkie).

CEE moves offices

The editorial and advertising offices of Canadian Electronics Engineering were moved to the Maclean-Hunter head office building, 481 University Avenue, Toronto 2, on December 1. We shall be pleased to welcome any readers who wish to visit us at our new location. Correspondence should still be addressed to: P.O. Box 100, Toronto, Canada.

Ontario Hydro chairman James S. Duncan "takes over" as computer operator. Behind him, from left to right, are Fred P. Thomas, director of the Data Processing Division; A. W. Manby, the Commission's general manager; and E. M. Banks, assistant general manager and comptroller.

LOW COST, TOP QUALITY, ELECTRONIC EQUIPMENT—

in kit form—by HEATHKIT

GENERAL PURPOSE 5" OSCILLOSCOPE
Model OM-3 $48.95

Features wide vertical amplifier frequency response, extended sweep generator operation, and improved stability. Frequency response of vertical amplifier is within ± 3db, from 4 CPS to 1.2 mc. Vertical sensitivity is 0.9 volts RMS per-inch at 1 kc. Sweep generator functions reliably from 20 CPS to 150 kc. Modern, etched circuit board provides faster, easier assembly. Amplifiers are push-pull type. Provision for external or internal sweep and sync, built-in 1V peak-to-peak reference voltage and calibrated grid screen.

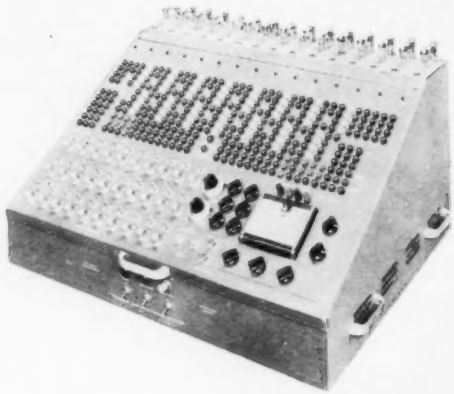
This is a fine scope, a prime favorite with service and lab technicians right across Canada!

ANALOG COMPUTER Model ES400
$1129.95 complete

A highly flexible, highly accurate, industrial quality computer—designed to fill requirements not presently met by any commercial computer. Because it comes in kit form without high assembly costs, it is priced well within the range of smaller companies and institutions. It has a unique patchboard panel that enables the operator to "see" his computer block layout. Equipment includes 30 coefficient potentiometers, as well as auxiliary potentiometers and up to 15 amplifiers.

The cabinet houses power supplies, amplifiers, and computing components, and an accurate dividing network which introduces voltages to a null meter. By means of a simple switch, a potentiometer may be connected directly to the meter, eliminating inaccuracy due to potentiometer non-linearity, or loading. The dividing network and meter may also be used to set up initial conditions, to offset bias diodes, and to read any voltage that appears at the amplifier. Meter may be switched to any of the amplifiers, which may be set to give full scale deflection of ± 2, 20, and 100 volts.

The Heathkit Analog Computer is available in three different groups, at three different prices. The basic group with 5 amplifiers costs $622, and the medium group $910. The full computer with 15 amplifiers and other extras is priced at $1129.95.



CAPACITY METER Model CM-1
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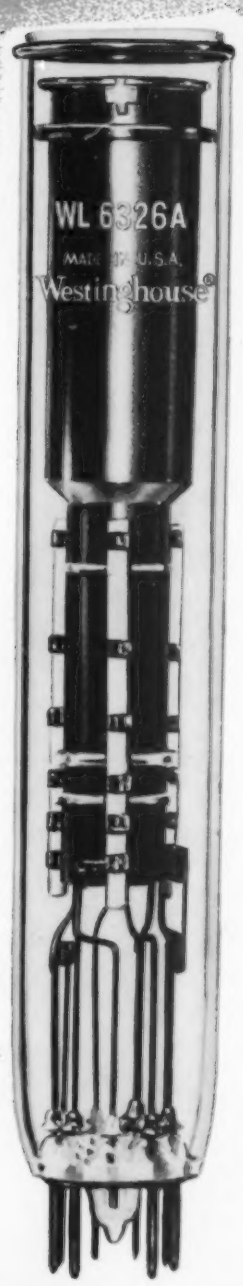

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Engineers and scientists who were engaged on the Sparrow II and Astra programs were retained by their employers until October 25 under a "stay-of-execution" granted when the contracts were terminated on September 23. Since then some 200 of them have been reassigned to work on "stop-gap" study and research contracts awarded by the Department of Defence Production. Others are being retained at their companies' own expense. It is obvious that this state of affairs cannot continue indefinitely.

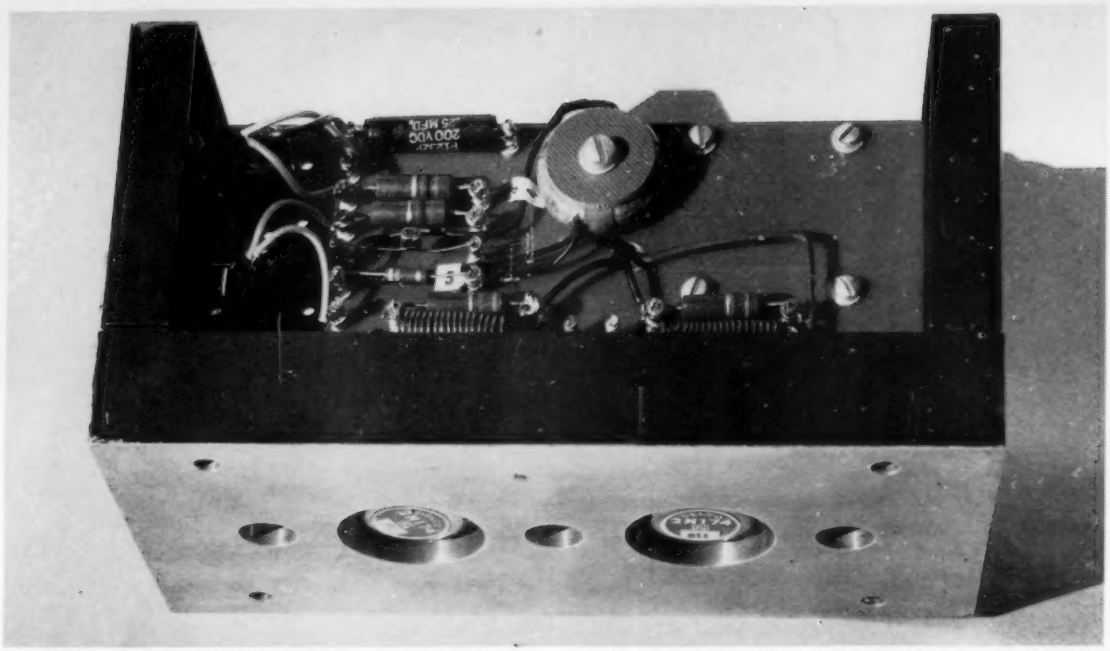
Negotiations are now under way with U. S. authorities regarding the placing of orders in Canada for some of the components of the weapon, detection and communication systems that will be required by NORAD. Can we hope in the near future for more than orders for minor "black boxes" that form only parts of major systems? Even if this kind of production work is obtained — and the presence of strong lobbying influences in Washington makes us doubtful of any immediate success — it still will not provide the right kind of incentive to remain in Canada for our research and development personnel.

The Government Liaison Committee of EIA met the Minister of Defence Production at the end of October. It is understood that Mr. O'Hurley gave his blessing to a proposal of the committee for closer co-operation between the industry and the Department of National Defence. Discussions with DND are planned for the near future, in which EIA will propose regular contact between industry representatives and the Chiefs of Staff or senior members of the individual services.

This would enable the services to keep the industry aware of their present and future operational requirements. Companies would then be able to submit proposals to the services for the filling of these requirements, and plan their facilities and personnel accordingly. Another issue raised with DDP was that of the modifications that would be required to the flight and fire control system for the Arrow if it is ordered into production. EIA is urging that this engineering work be done by Canadian firms.

However, these issues cannot affect the immediate picture. One is concerned with long-term planning, and the other with a program that quite possibly may not arise. The situation looks pretty bleak for an important section of Canada's technical manpower strength. Possibly the solution lies in the words of the Pentagon official who was recently quoted as saying: "In this world you've got to squawk to get heard and get some business. And squawking is the U. S. way of doing things."

THE EDITOR



60-watt low-frequency amplifier with cover removed. The transistors are mounted in the one-inch-thick aluminum block

Low frequency transistor amplifier delivers 60 watts

D. G. W. MACE & R. N. BLUNT*

A design philosophy is presented for transistor power amplifiers. The problems of heat dissipation, thermal stability and gain stability are examined. A particular design for a 60-watt, low-frequency unit is described, with details of the circuitry and the heat exchanger used

Designing a transistor power amplifier is a matter of reaching a compromise between a set of conflicting electrical, thermal and mechanical requirements. This compromise may be based upon the following minimum specifications:

1) Output power
2) Temperature range of environment
3) Power gain required
4) Input and load impedance required
5) Frequency of input signals.

The principle part of the amplifier design is in the various aspects of the output stage and for this purpose the first two items are required. The output power will suggest the rating of the transistors to be used and performance consideration the class of operation which will be adequate. Having settled these two questions it is possible to determine from efficiency considerations the energy liberated at the collector base junction.

General dissipation

Now consider what happens to the internally-dissipated energy at the transistor. This energy must flow in the form of heat from the collector to the surroundings. The path it follows is by conduction from the collector junction to the case or mounting stud of the transistor, thence to the surroundings by a more or less complicated path of conduction and convection transfers. It is this path in which we are at present interested. A knowledge of the energy liberated at the transistor collector, the maximum allowable junction temperature and anticipated maximum ambient temperature leads at once to a heat impedance in °C/watt. This impedance is the maximum allowable temperature differential divided by the maximum power calculated to flow across this differential. The impedance of the path between the collector and the surface upon which the transistor is mounted is composed of two parts—the impedance of the transistor itself and any electrically insulating washer or bushing required by the design of the transistor. The rest of the impedance will be termed the heat exchanger impedance. When this latter impedance is determined we can decide upon the form of heat exchanger to be used.

*Canadian Westinghouse Company Ltd., Hamilton.

Various possibilities exist and the particular one to be selected probably will be determined by ulterior considerations. The simplest arrangement is to design the case of the unit to have a sufficiently low heat impedance. If this is not practicable from considerations of size, another possibility is some form of finned device which will increase the available area for convection cooling in a given volume. Liquid cooling is also a possibility. If this is regarded as allowable, then the smallest heat exchanger will result.

So far we have regarded the maximum energy as being dissipated continuously. If this is not so, then we may design a heat exchanger having adequate thermal capacity—i.e. a long-time constant, to absorb the anticipated peak energy packets and transfer, on average, the total energy. We may now suppose that a parameter H_t exists which specifies the heat impedance existing between the collector and the surroundings of the completed amplifier. This impedance will be adequate to protect the transistor under the rating restrictions and ambient conditions so far imposed. However, we have supposed that the efficiency and required output power are adequate to determine, with certainty, what will be the internal dissipation in the transistor. This is not completely true until we have designed the electrical and thermal paths to prevent runaway of the system.

Stability considerations

Runaway in transistors is caused by the leakage of current (termed I_{Co}) across the collector-base junction. This current, as its name suggests, is the leakage current which occurs when the diode junction forming the base collector region is biased in its off direction. As a consequence the reverse or back leakage current of this diode is present in the base circuit of the transistor, superimposed upon the genuine transistor action currents. This is shown in Fig. 1.

If all of this current flows out of the base terminal and back into the supply we simply have an additional collector current. However, if there is a finite resistance (R_s) between the base and the point to which the emitter circuit is returned, some of this I_{Co} will flow into the base-emitter junction of the transistor and will be amplified in a manner similar to any other input current. This increase in the collector current will result in increased dissipation at the collector and hence raise the collector junction temperature. It is a property of the collector junction leakage current that it approximately doubles for every 9C increase in collector temperature. We see, therefore, that any rise in junction temperature will result in an increase in I_{Co} and this in turn may cause an increase in junction temperature. Such a mechanism can obviously run away if the loop gain is high enough.

Having fixed the heat impedance—that is the relation between junction dissipation and temperature rise—the only other factor we can control is the fraction of the I_{Co} which is forced into the base emitter junction. This will obviously depend upon the ratio

$$\frac{R_s}{R_s + R_{in}}$$

where R_s = the driving source dc resistance
R_{in} = transistor dc input resistance

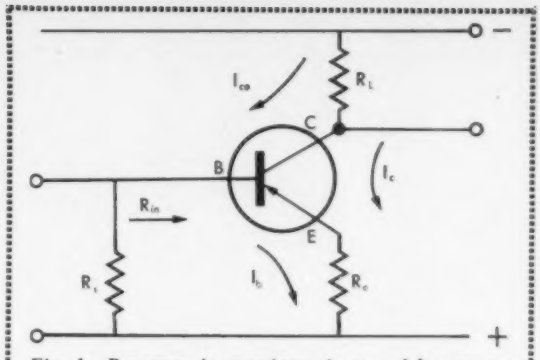


Fig. 1. Runaway in transistors is caused by current leaking across the collector-base junction

A typical value is

$$\frac{R_s}{R_s + R_{in}} = \frac{1}{20}$$

We may now see that the junction dissipation due to I_{Co} is given by:

$$I_{Co}\ V_c\left(\frac{GR_s}{R_s + R_{in}} + 1\right)$$

where G is the current gain in the transistor
and V_c is the collector potential

Since I_{Co} doubles for every 9C rise in junction temperature the rate of increase of dissipation at the junction is:

$$I_{Co}\ V_c\left(\frac{GR_s}{R_s + R_{in}} + 1\right)\frac{1}{9}\ \text{watts/deg. C.}$$

The rate at which heat can flow out is:

$$\frac{1}{H_t}\ \text{watts/deg. C.}$$

That is, stability will be maintained at any junction temperature as long as—

$$\frac{I_{Co}\ V_c}{9}\left(\frac{GR_s}{R_s + R_{in}} + 1\right) = \frac{1}{H_t}$$

This is the thermal stability equation.

We are now in a position to commence the electrical design of the circuit, for we have fixed limits upon the dc input resistance of the base circuit of the transistor and the amount of external dc resistance across these terminals.

If we suppose that we are going to use the transistors in grounded emitter, since this connection gives maximum power gain, then we are at once confronted with the question of how to drive the output stage. Consideration of the relative values of R_s and R_{in} already described shows that use of conventional condenser coupling is not satisfactory since in the typical case quoted only 1/20 of the drive current flows into the transistors. The rest will be by-passed into the coupling resistor R_s. We are assuming here that the dc and ac input resistances are equal. This will be the case, particularly at these high power levels under consideration, since the impedance levels are so low that decoupling condensers become prohibitively large. A more satisfactory solution to this coupling problem can be reached through the use of transformer coupling. It then becomes a question of

Table 1

Feedback	Current Gain	Voltage Gain	Input Impedance	Power Gain	Loop Gain
Series	G	$\frac{1}{\lambda}$	$R_{in} + \lambda G R_L$	$\frac{G}{\lambda}$	$\frac{\lambda G R_L}{R_s + R_{in}}$
Shunt	$\frac{R_{f2} + R_{in}}{R_L}$	$\frac{R_{f2} + R_{in}}{R_s}$	$\frac{R_{in}(R_L + R_{in} + R_{f2})}{G R_L}$	$\frac{(R_{f2} + R_{in})^2}{R_L R_s}$	$\frac{G R_L}{R_{f2} + \frac{R_s R_{in}}{R_s + R_{in}}} \times \frac{R_s}{R_s + R_{in}}$
No Feedback	G	$\frac{G R_L}{R_s + R_{in}}$	R_{in}	$\frac{G^2 R_L}{R_s + R_{in}}$	0

designing a suitable transformer to have a low enough secondary dc resistance to meet the previously determined restriction on $\frac{R_s}{R_s + R_{in}}$.

Having specified this coupling transformer we are now in a position to repeat the whole of the above process on the driver stage and hence work back to the input of the amplifier.

Amplifier gain stability

The next question which has to be determined is the gain stability required in the amplifier in order that gain variations in the transistors and their effects upon input impedance and amplifier gain may be determined. These considerations will indicate whether or not feedback is required and if so how much.

In this connection it is important to specify which gain is to be stabilized since transistors have a finite input impedance and feedback can modify input impedance coincidentally with stabilizing voltage or current gain. The designer must decide, therefore, if he intends to stabilize voltage, current or power gain. Stabilizing two of these may require the use of two feedback loops.

Table 1 is a summary of the effects of shunt and series feedback on an amplifier having input resistance R_{in} and current gain G. We suppose for a simple description of the problem that the amplifier is a current source and is driven from a source impedance R_s, as shown in Fig. 2. Two forms of feedback are considered, series feedback of output voltage, the feedback being λ, and shunt feedback of the output voltage through the resistor R_{f2}. The results assume loop gain larger than unity and obviously apply for reactive impedances as well as for resistances.

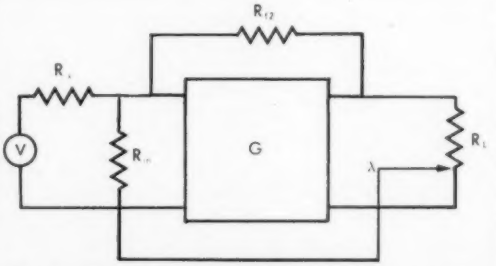


Fig. 2. Shunt and series feedback on an amplifier having input resistance R_{in}, gain G—see Table 1.

The well-known phenomenon, that the load impedance will affect the input impedance is quite apparent here. However, it can also be seen, that if so desired, by using a combination of series and shunt feedback this effect can be minimized.

Design requirements for a 60 watt amplifier

The following requirements were established for the transistorized, low frequency amplifier.

1. 60 watts output.
2. Ambient temperature maximum 50C.
3. 45 db Power Gain.
4. To drive a 60 cps servo motor.
5. Voltage gain to be stabilized ± 2 db.
6. Input impedance to be in the region of 5000 (making it suitable for matching to other transistorized equipment).

To achieve these high power outputs, it is convenient to work the transistor in Class B Push-Pull. This is dictated by considerations of transistor dissipation. Hence the circuit for the output stage will look like Fig. 3. It is expected to achieve a collector efficiency of 75% for this stage. This will result in a power dissipation in the transistors of $60 \times \frac{25}{75}$ watts i.e. 10 watts per transistor.

The Delco 2N174 power transistor has a quoted maximum junction temperature of 90C.

For reasons stated later it is proposed not to exceed 85C. With a maximum ambient temperature of 50C, this immediately gives a figure of $\frac{85 - 50}{10}$ = 3.5C/watt for the total heat impedance from junction to the surroundings. The heat impedance of the transistor itself can be determined from the manufacturers' data sheets. This is either presented in deg. C/watt or can be derived from the derating curve. In this case the figure is 1.7C per watt which includes a .002″ mica insulating washer. This leaves 1.8C per watt as a design figure for the heat exchanger.

Using the empirical formula

$$A = \frac{q}{h\Phi}$$

where A = area in sq. ft.
Φ = temperature difference in deg. F.
q = rate of heat flow in btu/hour
h = 0.27 to 0.25 (for vertical fins)
it can be shown that it is necessary to have 1.66 square feet of cooling surface per transistor.

If we assume that this is a vertical fin with cooling on each side it would result in a plate 11″ square for each transistor. This assumes that the fin is at a uniform temperature, which is not likely to be so unless it becomes inordinately thick.

Further consideration of this problem gave rise to the design of a stack of fins 4″ square mounted on a central conductor element 1″ in diameter. Experiments with this configuration indicated that there was apparently a volume effectiveness to the device, insofar as increasing the number of fins by a factor of two but still occupying the same volume made no appreciable difference to its effectiveness. Experiment has determined that the closer fin spacing is not responsible for this effect. It seems, therefore, that a heat exchanger of a certain capacity must occupy a certain minimum volume.

The final design used in this amplifier uses 9 plates of 1/16 aluminum 8″ × 4″ spaced 1/4″ apart. Three 1″ diameter conductors distribute the heat flow among the fins. Provision has been made for other forms of cooling by mounting the transistors in a 1″ thick block of aluminum which forms one side of the amplifier box. The heat exchanger, no matter what its form may be, can then be bolted to this block.

Stability

We must now examine the question of thermal stability. Since this is almost entirely tied up with leakage current (I_{Co}), a batch of 20 such transistors was checked in the laboratory and found to have a range of leakage currents from 120-170 micro-amps. This was at junction temperatures of 25C.

Taking 200 micro-amps as a safe design figure, and since the leakage current will double for every 9C rise in junction temperature, the anticipated I_{Co} at 85C should be 20 milliamps.

Examining the stability equation previously stated it can be seen that this falls into two parts, one of which is related to electro-thermal consideration and the other to the electrical circuit.

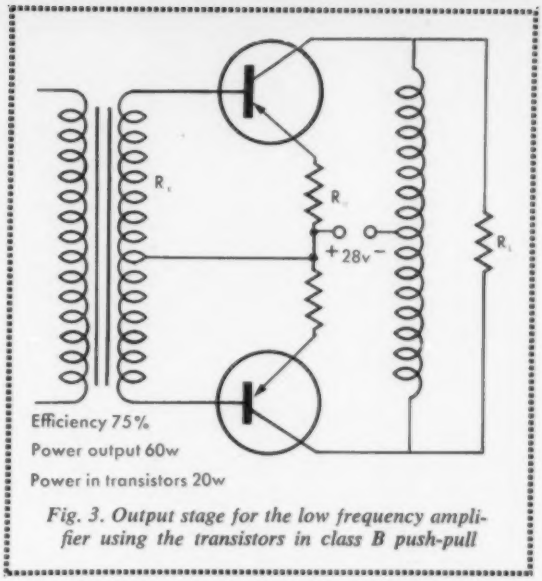


Fig. 3. Output stage for the low frequency amplifier using the transistors in class B push-pull

$$\frac{I_{Co}\, V_C\, H_T}{9}\left(\frac{GR_e}{R_e + R_{in}} + 1\right) < 1$$

Substituting already known values in the electro-thermal part of this equation we arrive at the following result:

$$.235\left(\frac{GR_e}{R_e + R_{in}} + 1\right) < 1$$

or $$1 + \frac{GR_e}{R_e + R_{in}} < 4.3$$

V_C is assumed to be 30 volts

This number (4.3) is known as the stability factor S.

To achieve this value of stability factor (consistent with a reasonable driver transformer design) it is necessary to increase R_{in} by inserting resistance (R_e) in the emitter lead. This results in an increase in input impedance $(1 + G)R_e$ due to the emitter follow-

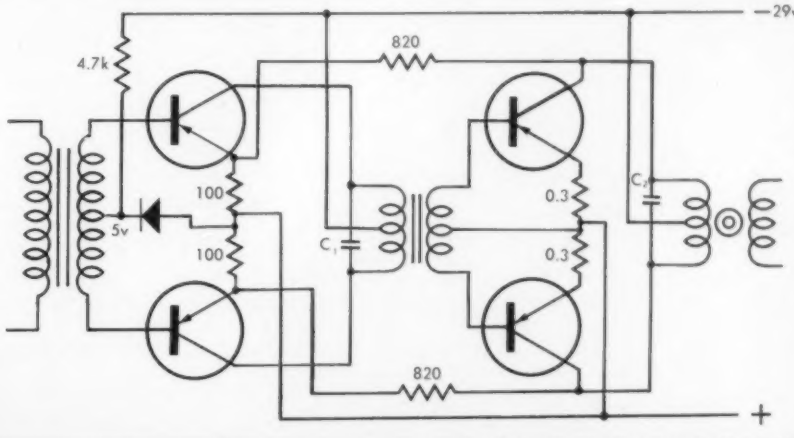


Fig. 4. The driver and output stages for the low frequency 60 watt transistor amplifier described in the text

ing action. Experience has shown that 0.3 ohm is a suitable value for this. Hence the expression becomes:

$$S = 1 + \frac{GR_s}{R_s + R_{in} + (1 + G)R_e}$$

$G = 50$
$R_{in} = 2.5$ ohms
$R_e = 0.3$ ohms

Again substituting known values in this equation, a maximum figure for R_s can be derived. In this case it becomes 1.13 ohms.

It should be pointed out here that some relief can be obtained in this restriction on R_s by increasing R_e but this will result in both decreased power gain and maximum available output power.

Consideration of the effect of temperature on I_{Co} and its consequent effect on the stability factor, determines the choice of 85C as a maximum junction temperature.

We now have a specification for the maximum dc resistance of each half of the driver transformer secondary. Before completing the specification for this transformer it is necessary to consider the previous stage of amplification. In this amplifier, it takes the form indicated in Fig. 4 which gives the complete circuit.

Heat dissipation and thermal runaway are equally important here and must be investigated as before. However, it is found that in using the CBS 2N158 transistor no special heat exchangers are necessary.

The Zener voltage reference diode is a convenient method of establishing a bias potential, without inserting a substantial resistance in the base circuit of this stage.

Examination of the operating limits on this stage will determine the peak voltage swings available on the transformer primary and hence the turns ratio required to give full voltage drive to the output stage. The dc current in the driver is determined by the required maximum current drive to the output stage and the coupling transformer ratio. This approach is adopted since manufacturers' curves specify input voltage and current for the output transistors and also the range of current gains. These, combined with requirements on emitter current, result in estimation of maximum voltage and current drive.

Before determining the inductance of the transformer one must consider the gain of the feedback loop with relation to the bandwidth required. Also it is advisable to assume that there will be some dc unbalance current present in the primary, say 1 ma throughout the whole winding.

It is important at this stage to consider the possible variations of the transistor parameters. Manufacturers allow a fairly wide tolerance when selecting transistors for a particular group. For instance, the 2N174 can have a current gain variation of 2:1. This will have a direct effect, in this amplifier, on the input impedance and power gain of the output stage, although in this particular configuration, the voltage gain is not likely to be affected appreciably due to the emitter following action of the 0.3 ohm emitter loads.

With these considerations in mind it was considered that a loop gain of 3.5 was sufficient to hold the overall voltage gain to within 2 db.

Generally speaking, the aim of this article has been to present information from a variety of sources in a concise design philosophy. Application of these techniques should enable design engineers to build rugged, reliable transistor amplifiers which are more compact and efficient than their tube counterparts. END

Mexican conference highlights export markets

R. GROVES*

The 2nd Exposition and Congress of the Electrical and Electronic Industries of Mexico, opened its doors on October 31 at the National Auditorium in Mexico City.

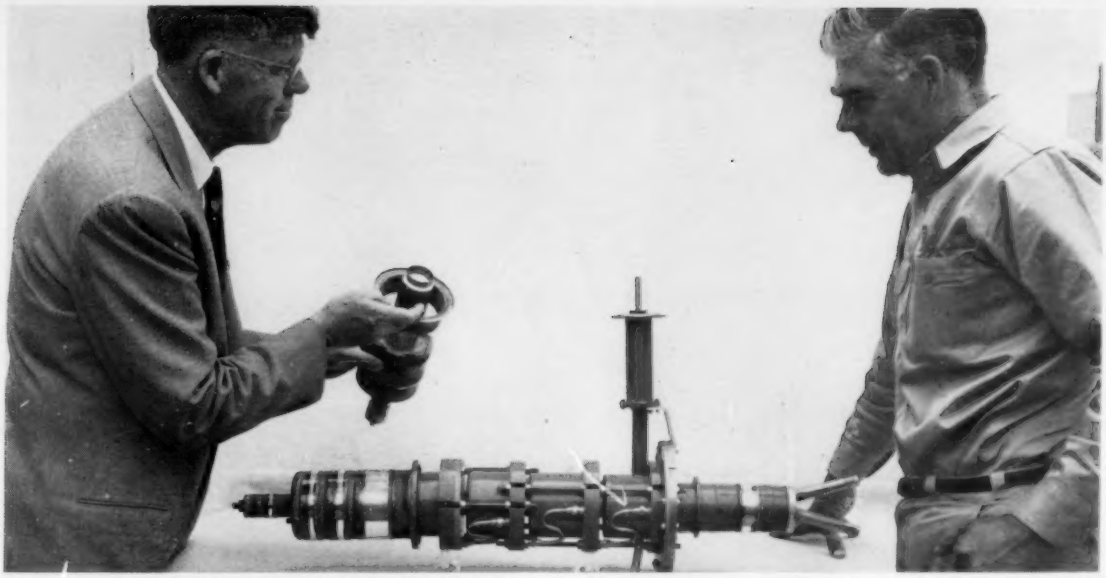
Sponsored by the Association of Mexican Electrical and Electronic Engineers and enthusiastically supported by the industry and the Government, the display reflected the peaceful application and acceptance of electronics in a rapidly growing and industrializing country. The first Exposition and Congress was held in December 1956 and in two years the number of exhibits has just about doubled. The emphasis in the displays was centred around communications, industrial electronics, radio and TV broadcast equipment and domestic radio and television sets with a liberal and somewhat noisy dash of hi-fi.

The international character of the electronics business was reflected in the strong representation of Canadian, British, American and German companies. The largest equipment on display was the Canadian General Electric BT-50A 50 kw broadcast transmitter, whilst the Collins stand featured items of communication equipment built in Canada.

The activities of the Congress, defined separately as the 2nd National Congress of Electronic Telecommunications and Broadcasting, were limited to the first week from November 1 to 7. The papers presented covered a wide range of subjects divided into four major sections covering technical presentations on aspects of electronics, the growth of educational facilities and methods, the importance and implementation of the domestic manufacture of electronics and finally a series of presentations on the planning for the public services of communications, air traffic control and broadcasting. In the last section, emphasis was placed on the necessity for high-grade communications between the North, Central and South American countries primarily as an aid to commercial growth and as a strategic necessity for the political and military harmony of the North and South American continents.

The exhibition closed on November 17 and very good attendance by the public contributed to the success of this meeting of engineering, industrial and marketing talents associated with the future of electronics in Mexico. END

*Canadian General Electric Co. Ltd., Electronic Equipment and Tube Dept., Toronto.



Dr. Russel Varian (left) and Sigurd Varian, inventors of the klystron, compare small early version with modern one

Klystron celebrates twentieth birthday

IAN R. DUTTON, ASSOCIATE EDITOR

There was a brief flicker on the fluorescent screen, then darkness. Try as they would, the two research workers could not reproduce the results again. But that brief flash proved that the new invention, the klystron, had produced oscillations in the microwave region.

It was not until the third model had been built that the Varian brothers, Russel and Sigurd, were able to control the tuning with sufficient accuracy to produce oscillations repeatedly.

All this took place 20 years ago at Stanford University, California. The klystron was a major breakthrough in the production of high frequency oscillations and it came just in time to help the Allies win the struggle against the Luftwaffe in World War II.

These are the major events leading up to the development of the klystron.

After a few years' experience in television research Russel H. Varian returned to Stanford University in 1933 to continue work for a doctor's degree in physics. While there, he worked with Dr. W. W. Hansen to try and find an economical method of producing high voltage x-rays.

Preliminary investigations led Dr. Hansen to believe that a concentric line resonator might produce the desired results. But he felt there might be a possibility of designing a more efficient resonator.

During this period Sigurd Varian served as a pilot for Pan American Company. Later he resigned to establish a laboratory for ruling diffraction gratings.

However, these were days of growing world tension. Hitler was rising to power rapidly and the Varians, like many other people, were becoming quite concerned about the growing strength of the German air force. They knew that a pilot could locate and bomb a target without seeing it or being seen. Some means of detecting aircraft must be devised, and it must be independent of light or climatic conditions.

After lengthy discussions Russel and Sigurd Varian conceived a form of radar for locating aircraft. From his work in physical optics Dr. Varian was able to predict the frequencies that would have to be used. They would be much higher than could be produced by any equipment available at that time.

During this period Dr. Hansen had continued his high frequency studies and obtained mathematical solutions for certain types of hollow resonators. His work indicated they would be much more efficient than the concentric line resonators.

The Varian brothers decided to abandon their ruling engine project and return to Stanford University to concentrate on the development of radar equipment. The university had offered them facilities and stock of the machine shop plus $100 to buy parts.

They had spent about half of their $100 allotment when they completed a working model of the klystron.

After lengthy discussions Dr. Hansen and Dr. Varian decided that the hollow resonator could be used to produce the high frequencies for radar, but a new type of current control would be needed. They concluded that the velocity grouping principle held greatest promise.

Less than three weeks later the design had been established and the Varian brothers began to build their first klystron.

They faced other problems too. How could they detect oscillations at microwave frequencies? No equipment existed that could be relied to work at such high frequencies, so they devised their own methods.

A small part of the electron stream was allowed to escape through a hole in the last resonator and impinge

upon the fluorescent screen. It was in this way that Sigurd Varian saw evidence of oscillation in the first klystron in 1938.

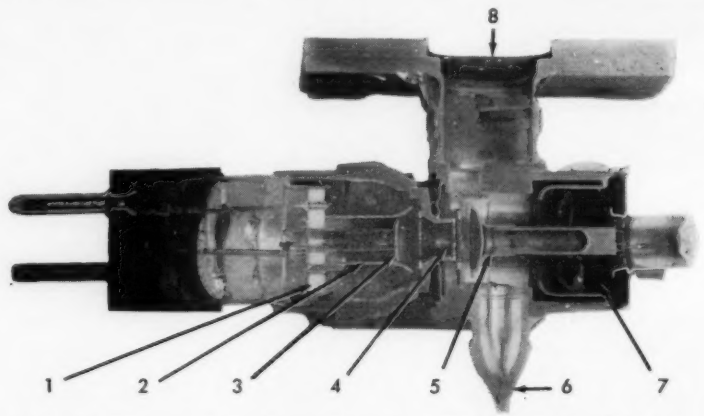
American government agencies were interested in the new development, but action could not be taken quickly. Meanwhile, the Sperry Gyroscope Company learned of the klystron and realized that it could lead to detection equipment that would supersede their military searchlights. Their offer to support the project was accepted by the Varian brothers. Subsequently they moved to Garden City, Long Island where they worked on klystron development throughout World War II.

In 1948 Russel and Sigurd formed Varian Associates, a company devoted to the development and production of klystrons. Since then they have expanded to other products and a total staff exceeding 1,300. Consolidated sales for 1958 reached $19,543,232, an increase of 16% over the 1957 figure.

Expansion has taken place in other ways too. Varian Associates of Canada Ltd. was established in 1955 with manufacturing facilities at Georgetown, Ontario. Today the Canadian subsidiary is producing klystrons for sale in the United States, sometimes in direct competition with the parent company.

With one or two exceptions the staff at Georgetown has been recruited locally and trained for the complex job of making klystrons. To see how these specialized tubes are made CEE visited Varian Associates of Canada Ltd.

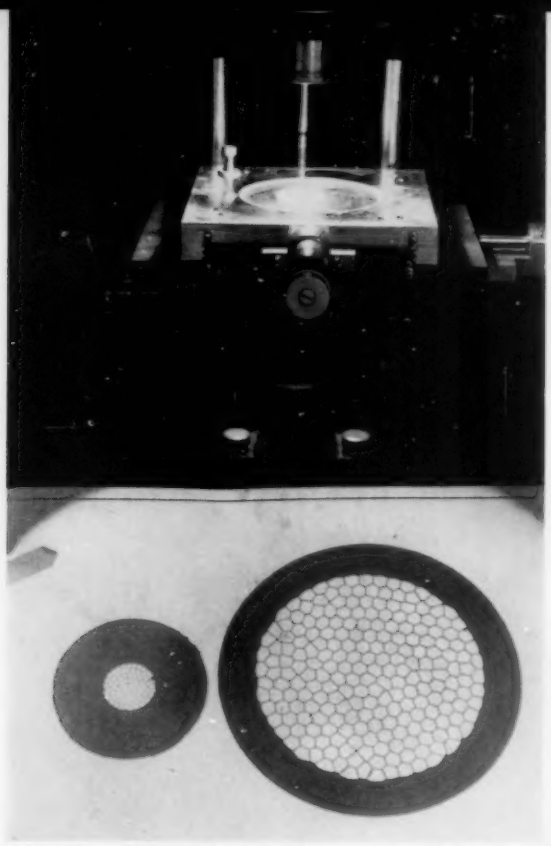
These are the major steps in the production of klystrons



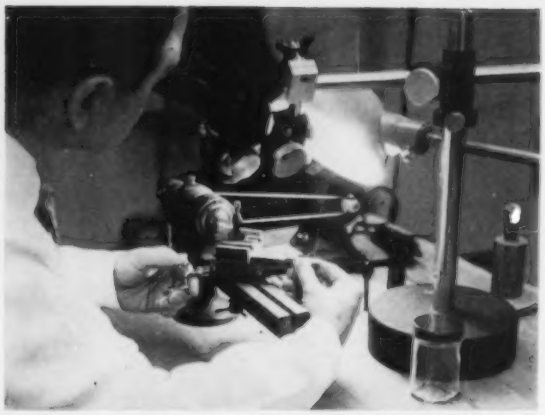
Cut-away view of klystron shows the major parts. 1. Ceramic header; 2. Focus assembly; 3. Cathode; 4. Grids; 5. Reflector; 6. Exhaust head; 7. Reflector header sub-assembly; 8. Microwave window. The numbers used in the following captions refer to these parts of the klystron.

Ceramic is painted on the headers (1) with a slurry, then baked at extremely high temperatures. Painting assures vacuum-tight seals between metal and ceramic

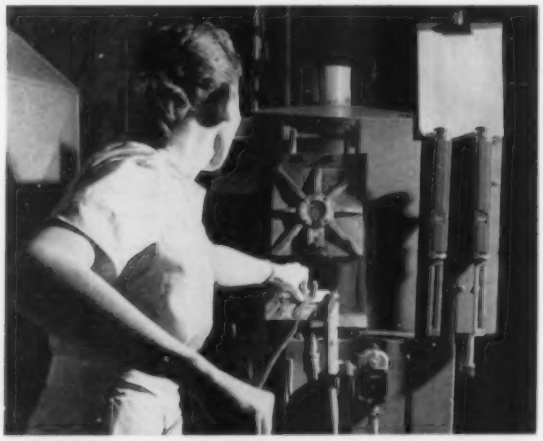
Coatings are formed on the cathodes (3) by placing them in holders on a 45 rpm turntable, then spraying for precise time. Slurry is sprayed at high pressure using dry nitrogen



Grids (4) are made by coating aluminum wire (0.005 in. dia.) with high purity copper until the coating is 0.0002 in. thick. This coated wire is cut into lengths of 8 in. or 10 in. and threaded into a copper tube of the same length. The tube is then swaged and sintered until the copper coating adheres. The material is then sliced into thin sections and lapped to the desired thickness. When the aluminum is etched away the grids are complete. In this picture the small grid on the left (seen through an optical comparator) has an outside diameter of .125 in., grid diameter of .040 in. and 50 holes in the grid. The large grid has an outside diameter of .260 in., a grid diameter of .210 in. and 200 holes.



Trimming grid and drift tube assemblies requires use of a jeweller's lathe and microscope. Tolerance is about .0002"

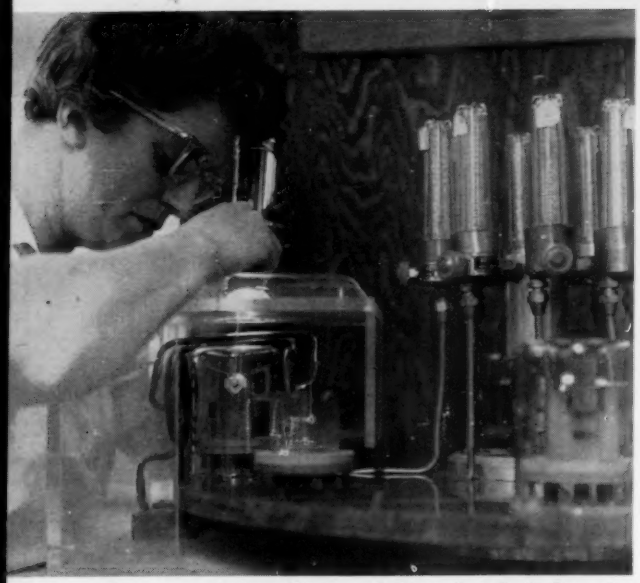


When the ceramic headers (1), focus assembly (2) and grids (4) have been assembled in the main tube body they are all brazed at one time in a furnace heated to about 900C.

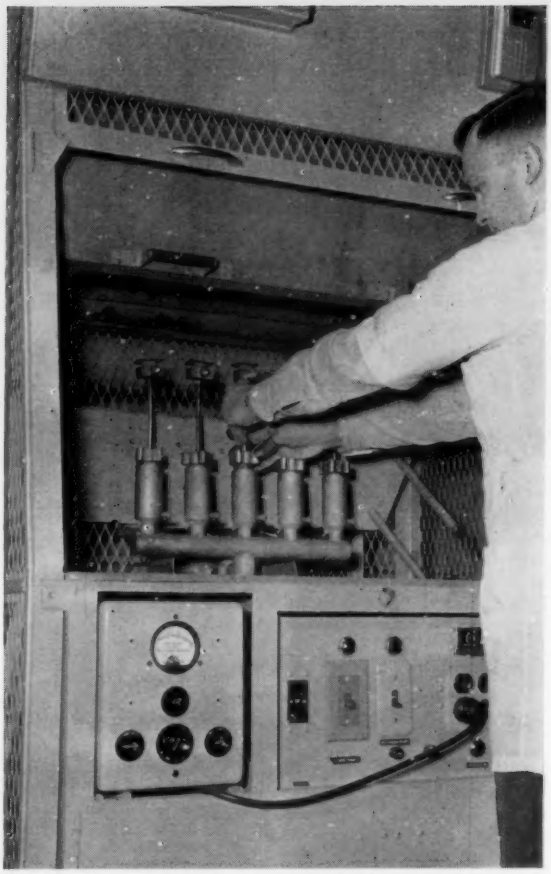
The reflector header sub-assembly (7) is placed in the tube body. Operator uses a microscope to assure proper assembly and works under a dust hood to avoid contamination

After assembly the reflector header (7) is brazed into the tube body. This is done by induction heating in a dry nitrogen atmosphere. Operator is loading body in brazer

Klystron production



Microwave windows (8) are sealed into the tube bodies using soft solder glass and induction heating in dry nitrogen



With all parts of the tube in place it is exhausted, then the copper exhaust tube is pinched to form a seal (6)

Silastic is molded around the leads to prevent break-down at high altitude. Operator is taking a tube out of the transfer mold while second tube is being cured in machine

Final operation is to check all characteristics of every tube to ensure they meet specifications. Three such stations are used by Varian Associates at Georgetown. END

New committee member R. Demers (second from left) checks details with the 1957-58 committee. From left: W. Nunn, CFPL-TV, London; R. Demers, CFCL, Timmins; E. Victor, CHML, Hamilton; F. Lehman, CFRB, Toronto; W. Onn, CHLO, St. Thomas. Other committee members for 1959 are C. Eastwood, CFRB, Toronto, and J. Barnaby, CFCH, North Bay.

7th Annual CCBA Engineering Conference

Broadcast engineers review progress

On October 28 nearly 100 broadcast engineers from Ontario and Quebec registered in at Toronto's Westbury hotel. This was the 7th Annual CCBA Engineering Conference.

In two busy days the delegates attended technical sessions, held a business meeting, looked over displays of new broadcast equipment, toured the Trans-Canada microwave facilities in Toronto, and talked shop with fellow engineers.

Nine technical papers were delivered on various aspects of broadcasting. They were:— "Microphone facts" by Lou Burroughs of Electro-Voice, Inc.; "The use of transistors in broadcast equipment" by Wally Benger of Northern Electric Co.; "Field mesh image orthicons" by Walter Turk of English Electric Valve Co.; "Picture quality and video testing techniques in TV broadcasting" by Andre Ste-Marie of CBC; "The need for supplementary proofs of performance" by Wilbert Smith of DOT; "Broadcast applications of emergency power equipment" by Dave Richardson of G. W. Crothers Ltd.; "Advance in broadcast transmitter design through the use of modern power tubes" by Charles Weden of Machlett Labs, Inc.; "The present status of stereo in broadcasting" by Tony Jamroz of Northern Electric Co.; "The new approach to TV transmitter design" by Dale Douglas of Canadian General Electric Co. Ltd.

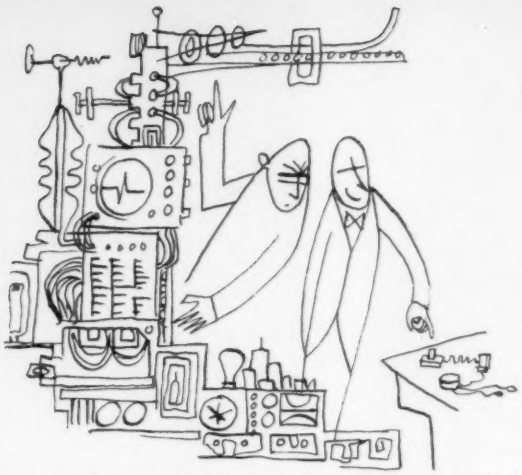
One highlight of the convention was a tour conducted by Bell Telephone Company. This gave the broadcast engineers an opportunity to see the Trans-Canada television network equipment and the Toronto system emergency power equipment.

Guest speaker at the banquet was Mr. Eric Palin, Ryerson Institute of Technology, Toronto. His subject was "The broadcast engineer as a citizen."

Eighteen exhibitors displayed their products in suites at the Westbury. One was too large to be moved upstairs so it greeted hotel guests in the lobby. It was the new 25-kw amplifier which is being installed at CKVR-TV, Barrie, Ontario. The equipment, built by Standard Electronics Corp. and purchased from Philco Corp. of Canada Ltd., will give CKVR-TV a full erp of 100 kw. END

Ken Stewart, CKLW, Windsor, was interested in new special effects console designed and exhibited by McCurdy Radio Industries. Ken MacKenzie provided the description.

This amplifier went to CKVR-TV, Barrie. L-R: A. Price, Philco; J. Mattenley, Director of Operations, CKVR-TV; W. H. Rappolt, Standard Electronics; R. Weese, Philco.



". . . then ask what is the value of some particular voltage or capacity, or the shape of some waveform—(now here is the masterstroke)—In some other circuit."

In the electronics business the alert and intelligent man wants to get ahead. This cannot be achieved by doing one's work diligently and steadily because in this way the A&IE* becomes lost among all the other A&IE's who are doing the same thing, hoping that their lucky break will come when the manager requires their assistance to solve some earth-shaking crisis which is causing the company to go out of business. These are the basic rules for the A&IE who would like to establish an aggressive policy toward the distant goals

Successful supervisorship

R. H. PARKER, P.ENG., CORRESPONDENT

There is much good literature on the subject of good supervisorship (see Bibliography) and this paper might be classed as "Application Lifemaneering" in that a body of general research is here applied to a particular field; one in which 'lifemanship' is particularly applicable because of the appalling exponential decay of analytic ability which sets in after graduation. Since keeping up technically involves hard work, there is considerable pressure to find other ways to compete. One should always bear in mind that when you are successful no one asks questions. If you can create the impression of success this is just as good and much easier.

Now it must be remembered that this is a guide and the most successful exponent will be he who can cloak the whole thing with much artifice and personal ingenuity in the application of the basic rules. A little practice (the cat will make a useful subject when practising questions, but when answers are required this has its limitations) will improve the subject enormously and without more ado we will plunge into the "text."

Supervisorship

We will discuss this branch as much as can be learned by the A. & I. E.* by a close study of the ploys and gambits† used by the A. & I. S.'s.‡

Difficulties will occur within your bailiwick from time to time and these may be grouped for study into a few groups (oddly enough). The first is technical. This sort of awkward thing usually arises when the requirement changed since the A. & I. E. designed the circuit and nobody told him about it, or it was decided at a higher level that his design wouldn't do what he said it would and would be all right, and then turned out that it wasn't O.K. and didn't go what the A. & I. E. said it wouldn't in the first place, and the whole thing is a mess.

Now, this is an easy situation to deal with and what is now recognized as Pillsworthy's inexperience ploy may be used. When the matter is being discussed particularly if the A. & I. E. who is concerned is present it is a simple matter so Pillsworthy tells us to start the ball rolling by saying "now we are all new to this game—(use the word "game" it gives a comradely jovial note which will soften some of the underlying rapier tones)—and it is to be expected that some mistakes will be made." Now the use of the word 'we' nominally includes yourself and sort of gives the feeling of buddies in a jam, but everyone knows who actually did the design so you have made the point that a first order blunder was made by you-know-who.

This leaves the A. & I. E. with the uncomfortable feeling that he has let the side down through lack of experience, that his fellows are being really decent about the whole thing and that he doesn't really mind that he wasn't

*Alert & Intelligent Engineer.
†A ploy is a remark not necessarily relevant to the subject but designed to achieve a required situation. A gambit is an opening remark.
‡Alert & Intelligent Supervisor

believed at first so he will buckle to and find a solution quickly. However, this would never do since it would undo all the good work done by the "Pillsworthy Ploy" so in a day or two's time or even at the same meeting you propose to call in someone from another group just to check the design "because" as you put it, "we have so much riding on this order that we must build a pretty strong hedge against anything going wrong in production."

This is a masterful stroke and it is a pity that the genius who first proposed it remains anonymous despite the researches of the famous historian A. E. Pinter. Perceive the symmetry of the move. Not only have you created the impression that you fear many other difficulties may be buried which (and here is the recommended phraseology) can be best dealt with "by someone who is new to the work who will see the wood and not the trees," but you have also established the geniality of your nature in indicating that anything could happen and it wouldn't matter a scrap if it weren't for those ugly fellows downstairs who create such a fuss when the stuff is being built. You are almost secure except for the fact that the A. & I. E. might turn up the solution before the "consultant" who in fact might not have a clue anyway so you phase out the A. & I. E. on that job due as you put it "to the general work load and the lack of personnel in more important fields." This makes sure that the solution when found appears to have been brought about by your statesmanlike manoeuvres, quick action, and keen mind.

The coup de grace is delivered in the words of the Italian master Finemino—addressing the A. & I. E.

"We would like to feel free to draw on your experience in this matter if we run into difficulty," however, any suggestions or ideas on the part of the A. & I. E. may easily be countered by such phrases as "this received a great deal of attention last week," or "this may have some merit—I'll pass it along." Or if the idea is really good and you are on a spot say "h'mm! if the present tack doesn't work out—we'll try this next." This is the basic framework and will work—with variations in most cases.

Supervising designs and experiments

It is here that the true art may be applied. It was in this field that Prof. Ganglin reached the pinnacle with what is known as his "other circuit theory" as applied to people who are working on circuits. Let us set up a hypothetical case where an A. & I. E. is working for you and is attempting to find some malfunction in a circuit (there is a variation which applies to circuits which will not give design performance but the technique is quite general. The essence consists in asking a question to which you are sure the answer is not available or is not known at once).

The procedure is to come round to where the A. & I. E. is working and start watching for a few moments. In case you have forgotten what he is doing for you or, as will happen, you don't have a clue about the circuit he is working on, Ganglin established the standard opening as (jovially spoken) "well! how are things going?". The wise lifeman will now listen very carefully to get the feel of the language and pick up a few ideas along the way. The A. & I. E.'s explanations of his results so far should be thoroughly plonked, that is you should repeat the last two or three words of each sentence with a sage nod of the head, give two or three uh huh's in rapid succession and at frequent intervals several meaningless grunts. This gives the impression that you are ahead of him in the implication of what is being said. When the A. & I. E. has finished his explanation—(pay particular attention to the stance, fully relaxed, foot on rung of chair, hands in pockets, head bent in thought) wait a few minutes and then ask what is the value of some particular voltage or capacity, or the shape of some waveform—(now here is the masterstroke)—"IN SOME OTHER CIRCUIT." Now if you have chosen well the chances are that the A. & I. E. will not have checked this as it is irrelevant anyway but you will have chosen the other circuit sufficiently close that it could have an influence. Since he is forced to say "I don't know" or "I haven't measured that," you have come out one up, again demonstrating that if you'd been doing it, this is one of the first things you'd have checked and probably saved a great deal of time. You must be careful, however, not to draw any conclusions from the probable phenomenon at the point of your questions so that nothing can be actually proved or disproved at a later date. If the A. & I. E. measures the subject of your questions and by fluke it turns out to be the cause of the trouble, your reputation is made. If it isn't anything to do with it the standard reply (Ganglin) is "well it is as useful to tie down the things which aren't the trouble as it is to find it," which is of course nonsense but establishes a reputation for scientific thoroughness.

Where only one circuit is involved of course then it is necessary to make some enquiry about a component

which you are fairly sure he hasn't measured yet, or about the result of a series of tests which you know that he probably intends to run but hasn't had time yet. Are you beginning to get the idea? Since it is never possible to measure absolutely everything at once right until the difficulty is solved you will always be able to pick on some area about which the A. & I. E. is unable to give a straight numerical yes or no answer. Should you misguess however, or get a quick reply then fall back if possible on what Ganglin called the "Test Equipment Rejoinder." It can go something like this.

You: "What is the peak voltage at the plate of V3 (for instance)?"

Experimenter: "102.93 volts ! !"

To the untutored this might look as if you were one down but the situation can be recovered quickly by attacking the fourth or fifth decimal place, saying: "Is this the scope that was acting up last week?" If the Experimenter just picked the scope up from the test equipment department the chances are 10 to a bean that he won't know if the fault has been rectified or if there was one at all, so you have cast doubt on his statement and further enhanced your reputation for thoroughness. If he has been using the same scope all along you have still made a partial gain because you can at once follow up with "well I'm not so close to the details these days that I'm familiar with all the scope moves around here—I guess it is one of the evils of too much paper work." This creates the impression that you have organizational ability as well as the background to discuss technicalities. In general, if it looks as if you

are going to go one down, shift the ground to a topic where you can go one up.

Cast doubts on reports

The same procedure can be used when the experimenter brings his report to you for discussion. Always ask a question about some other part of the circuit which will tend to cast doubt on the figures presented. If the figures are unassailable then the technique is a very fruitful area in which to work, especially in microwave work, where the mere mention of "stray capacity" can force even an experienced experimenter to admit that he has not measured "them" in at least one spot and this will tarnish weeks of painstaking work on his part.

In any case, under no circumstances accept the report as it is first presented; suggest alternatives of format, additional readings which should be taken, question the technique and the calibration of the test equipment. This all tends to establish you as one up on the experimenter and soon you will find that he will consult with you first about everything rather than rewrite or re-do it three or four times. When you have your people eating out of your hand in this way then you have established "Effective Control."

Watch that organization

The next group of problems is organizational. Now this is an important area and much study should be devoted to this section because a weakness here exposes your flank in a vulnerable way to all the people on your level and below. If things go wrong below, you then become vulnerable from above—which is the serious thing to be avoided.

Here again Pillsworthy has formulated the basic approach and it may be summarized as follows (this is known as Pillsworthy's second law of Bureaustatics). *

Never agree with someone else's idea — always counter immediately with your own.

Now the attentive reader will reply "what if I don't have an idea — which is most of the time." Take courage, all is not lost; in fact, much may be done by the use of Dilling theorum which states that "success = $(\text{quibble})^n$." It will be very seldom that someone makes a suggestion about which you can say nothing derogatory†. Look for any small point, especially figures, that you can get the suggester to admit that his facts may not be quite precise. The conversation might go like this.

Suggester: This routine makes it necessary to fill in 20% more questions than is really necessary.

Yourself: You think actually 20%?

Suggester: Well about 20%.

You have cast doubt immediately as to the validity of his figures. The rest of the suggestion might be brilliant but this one element of doubt is the lever to bring it crashing down. If he suggests a new format — rearrange it on the paper so that you have the same thing but put your way and if he points out several good reasons why it should be arranged the first way you can always fall back on the Pillsworthy inexperience ploy (modified) which would go something like—"well, when you've been at the business as long as I have, etc." — a word of caution here, make sure you have been at it longer or use another variation such as "if you had my experience" but don't be specific — selling brushes won't put you one up on five years at M.I.T. if your opponent calls to see your hand.

Don't overdo the first time but take it a little at a time until the suggester has brought the idea back perhaps three or four times, by then you will have modified the idea to the point where it is not worth putting into practice and will have established a reputation as a person with whom only really top notch ideas are acceptable. If this is diligently pursued you will soon find that you have a highly successful group insofar as you can get your ideas worked out without getting muddled with a lot of nonsense from other people.

One of the more useful ways to overcome other people's attempts to improve your area is to say with enthusiasm "I'm glad you brought this point up. I had a letter from so and so only yesterday on this very subject" (here pause and rummage in your "IN" basket — finally coming up mumbling something about 'the filing always gets done when you don't want it done" and then continue — "and it is being explored for possibilities." Usually this completely takes the wind out of the suggester's sails. There are several variations of this such as "I had a long phone conversation with so and so only last week about this very thing." There are two important things to note here. One is that you should always use the word "long"; this establishes the fact that the subject was dealt with in detail and hence you have given it a lot of thought; the other is to quote the name of someone as high in the company as possible. This establishes your personal importance and removes the likelihood of your story being checked upon.

Grab the credit for good ideas

If in the course of a discussion with someone they suggest an idea in which there may be the possibility of a great deal of personal credit as the originator, play it down as much as possible and then write about it to someone else (without a copy to the person you got the idea from). This establishes you as first with the idea in everybody else's mind which is what is required. If you think someone else is doing this to you in reverse say nothing about your ideas until you have them in writing yourself.

The proper use of a letter can be a powerful ally or if improperly used, the letter can be the cause of the biggest pitfalls. Much can be accomplished in these fields besides the technical, which will do much to round out your reputation as a versatile administrator and much as the technical end of it may interest you, don't ever neglect the paper work because here lies probably the most powerful weapon at your command. Whoever said that the pen is mightier than the sword, either worked on specifications or knew all about inter-office memos with a big distribution list attached, carefully selected to catch just the right eyes first.

The main situation is summarized in Pillsworthy's third

*Pillsworthy spent many years in the Civil Service, hence the name Bureaustatics.

†The odd one will arise of course and should be declared unworkable in public, then adopted privately over your own signature.

law of Bureaustatics which is "Never, Never, Never . . . Never* commit yourself in writing."

This can be most easily achieved by getting someone else to write the letter (by telling him what to say first). If all goes well you can take credit for the results. If things go haywire you can fall back on the "inexperience" gambit outlined earlier to adjust the situation. This particularly applies to making estimates. This is such a difficult business that no one ever gets them right, so never get identified as having produced one, always get someone else to make it.

Steer clear of estimates

The subject of estimates should really be treated in some detail as considerable skill is required to stay one up in spite of the cost being in excess of the estimate and the whole thing being way overdue. It can be done and the essence of the matter is not to show why your estimate is wrong; never admit this, but to show that it is grossly unreasonable that you should be asked to keep to it, and if you are really pinned down to show that the objectives were set by someone else over your violent objections.

Now as to the actual letter writing, if someone else is writing the letter and he asks for your approval make sure that you rearrange the layout and phraseology so that it says the same thing but in your way. This establishes a reputation for attention to details.

Another useful tip is to change the file number. This doesn't accomplish anything useful but it is easy to do since most of the files are so ambiguous that any one would do, and it all serves to satisfy Dilling's equation of success = $(\text{quibble})^n$.

Some people develop a quite voluminous letter output, no detail or event, or two words spoken with someone is too small to write a letter with 10 copies "confirming our . . . . . what ever it was of today, tomorrow, or yesterday." This habit is worth cultivating since it is really surprising how many secretaries you can keep busy and how much free advertising this practice provides. Incidentally it adds considerably to one's prestige to be able to "justify" your own filing cabinet. In any case, however much or little you write letters the essential thing is to make sure you don't have your name on anything that goes wrong.

Personal behavior is important

Now finally I think a couple of words about personal presentation and behavior are in order to round out the basic tools needed to Assure Success. In order to create a good impression it is necessary to always look busy. Keep your desk piled up with books and papers; however, always put the contents of the "in" tray in one of your desk drawers each day as this creates an impression of efficiency.

Always wait until the last minute before taking coffee break, this will do more than a dozen good ideas to create the impression of being a dynamo. In the same way always go down after everyone else has had their lunch. It doesn't matter that you take two hours for lunch instead of one at the proper time, no one will notice the overtime except when they call you on the phone and you aren't back at 2.30 p.m. You can of course always handle this situation by making sure that you go for lunch with any odd salesman who happens to be about and muttering to the secretary that you " . . . have important lunch date." As a matter of fact, it is a good idea to invite one in once or twice a week. It's good for a free lunch, even if you don't intend to buy anything.

*Pillsworthy's original statement included 9 "nevers" but these have been reduced here for simplicity.

If you intend to go for a walk through the plant, hold several sheets of note paper and a pencil in one hand and walk briskly. Nobody will question you, especially if you stop once or twice and look at the ceiling. You can put in a whole afternoon this way and at the same time create the impression that you are keeping your finger on the pulse of things.

The essentials are, wherever you go, always walk briskly and carry a few papers.

On tidying your work area, this is a must if you have someone working for you, to do it while you are tied up at an "important conference." If you are bottom man on the ladder, save this idea for a year or two.

Call in the furniture movers

Rearranging the office space or work area is another worthwhile habit to cultivate. If people in your group suggest a better layout to improve their working efficiency, hold them off as long as you can while you incorporate their idea into your own scheme. As a rule you will have to delay this long enough to get together a working number of ideas, as it is pretty tedious to think them up yourself. However, if you can keep each reorganization sufficiently useless, there is always lots of scope for another. For the higher ups this can be done with people and then it gets really exciting. Dilling showed that 5½ to 7 months was the optimum interval for this kind of thing. The reason that office rearrangement is so valuable is that while it creates the impression of being right in the forefront of progressive thinking, it is as safe as houses because it is totally irrelevant and cannot go sour on you as a consequence.

If you work carefully on all the above, it is surprising how fast the time will go, you will have put in five days a week without really trying hard, and in the process you will become established as a first rate administrator. Just remember, if you never contribute a new idea, no one can ever prove you wrong. Stick with the old ones and let someone else take the risk. END

Warning!

Anyone noticing an errer or an emission or misquotation will not be liked for trying to go one up on the author by pointing this out!

(Me too—Ed.)

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The 45,000 joule capacitor assembly used in fusion experiments at Aldermaston, England, showing discharge tube and some of wiring. Photos, courtesy U. K. Information Office.

Geneva conference underlines . . .

Electronics' future in nuclear work

LEONARD BERTIN*

While the 5,000 odd atom scientists and engineers of 68 countries who attended the 2nd International Conference on the Peaceful Uses of Atomic Energy in Geneva last September have recovered from the physical hardships they endured (it's been conservatively estimated that they walked 10,000 miles each day between them in the conference buildings alone) the task of assessing the full implications of information divulged there will take many more months.

It ranged over the whole field of nuclear science, from power technology to the use of radioisotopes in medicine; from fundamental physics to the search for minerals.

For most of the countries that sent representatives or observers, the conference offered a God-sent opportunity of acquiring for nothing a vast quantity of data that they could not have obtained on their own, even at the expenditure of hundreds of millions of dollars.

All they had to do in this case was to sit back and listen while the four leading atomic powers, the U. S., Britain, Russia and Canada, together with France, the latest comer to the field, displayed their knowledge in friendly but lively competition.

This does not mean to say that other nations played no useful part. All told, 46 countries and six international agencies contributed to the 77 different sessions which were often being held five at a time in different parts of the great Palais des Nations building overlooking Lake Geneva.

As in the case of so many international conferences, however, a great deal of the real work was done in the lounges and corridors, in roadside cafes and even in nightclubs. It is no exaggeration to say that in that small city every third man one met in the street, every second man one met in a cafe or eating house and almost every one in the cabarets was talking, not of the pretty girls that were in evidence everywhere, but of neutron cross-sections, improved designs of ionization chambers, better ways of controlling chain reactions, or more reliable ways of cladding fuel elements.

The outstanding result of the meeting was, from every point of view, the way in which it broke down international barriers, particularly those between Russia and her satellites on the one hand and the rest of the world on the other.

A noticeable example of this occurred at the beginning of the meeting when Britain and the U. S. jointly announced that they were going to drop all security wraps on work they were doing together to tame the H-bomb type reactions from which the sun and the stars gain their heat.

Russia made no similar promises for the future but Prof. Amelioranov, the senior Soviet delegate, did say that his country would release at once all the data that already had been gained in the field. Various papers and films presented to the conference left other delegates with the impression that they kept their word.

This security relaxation was wonderful news for more reasons than one.

The world will never be short of energy once scientists and engineers have mastered the secrets of these reactions, but this may not happen, possibly, until the turn of the century. Of far more significance to the **immediate** future was the fact that there, as in the world-wide International Geophysical Year program, scientists of east and west,

*Science Editor of the Financial Post, Toronto.

north and south, had found ways to surmount all national frontiers and work together for their common good.

For the electronics men this means that all the resources of industry can now be drawn upon freely, unhampered by security regulations, to speed up the pace of development. Any scientist in a university or private company who has the inclination to try his hand at this great problem, one of the most exciting and inspiring in history, will be able to gain free access to all the information that is available on the subject. Bona fide workers will also be freely admitted to establishments where such work is going on and will be able to inspect apparatus.

Fusion opens new fields for electronics

At a time when the business of controlling, regulating and monitoring fission reactors is becoming fairly standardized and proceeding along certain well-established lines, the challenge offered by the fusion problem is all the more interesting for electronic engineers. This is because the part that electronics plays in this new work is the major, and no longer a purely auxiliary, role and because the exact nature of that role may still remain to be discovered and could be the fruits of work of a comparatively small team with meagre resources.

Unlike fission, fusion also offers the hope of an important bonus—the possibility of direct transformation of nuclear energy into electrical energy without the need of boilers, turbines and conventional alternators.

In the meantime, there is a further and simpler possibility that is almost certain to be realized. This is the use of neutrons, produced by fusion processes, to breed fissile material in uranium or thorium blankets.

This more immediate alternative goes part of the way to explaining the tremendous emphasis on fusion in both papers and in the fact that 20% of all the exhibition space in the great exhibition at the Palais des Nations was devoted to the subject. The main reason, however, was a purely political one.

Prestige played an important role

The scientific aspects of the Geneva confrence scene can never be divorced from the backcloth of the rivalry between east and west. With two great power blocs to choose between and with the whole of their future, possibly, in the balance, many of the smaller nations have been sitting on the fence. They went to Geneva to see whether the great red Sputniks were the stars that they could most safely and advantageously follow or whether the U. S. was still in a position to maintain its leadership in technology —the thing that seems to matter most in the world we now live in.

Well, they saw and no one who did so could fail to be impressed by the wonderful and quite unprecedented show put up by the U. S. They were impressed, too, by Russia's contributions and most people, in spite of what Russia has achieved already, were still a little surprised to find how similar her research programs and results were.

In electronics, nuclear physics, accelerators, chemistry, the applications of radioisotopes in medicine, industry and research, and in power technology, it was clear that Soviet scientists are following along lines closely paralleling those of the West.

The significance lay not in the progress they had made along these lines—they were often well behind the West—but in the rate at which they are making up for lost time.

The U. K., it was interesting to note, demonstrated that she still is successfully maintaining a strong hand in every sphere of nuclear work. She leads the world in its practical utilization for industrial electric power production. Unfortunately, lack of the vast funds that the U. S. can spend, and also limitations of manpower, have prevented her from investigating on a practical basis a number of very promising fields for the future such as pressurized water and boiling water reactors.

This photo in the counting laboratory, Isotope Division of AERE, Harwell, England, shows the extent to which electronics is used in nuclear energy work.

Britain's experience at Windscale, where uranium fuel in a plutonium-producing reactor, caught fire following a release of pent-up "Wigner energy" in the graphite moderator and caused local contamination of land, indicated, as conference papers clearly showed, that much more instrumentation will in future be required in graphite-moderated reactors to ensure their proper and safe functioning.

Another factor that clearly caused some preoccupation was the announced discovery that such reactors may end up with a "positive temperature coefficient" once they begin to accumulate large amounts of plutonium.

This means, of course, that a rise in temperature of the core results in an increase of nuclear reactivity. U. K. men who have been studying this position in Calder Hall reactors claim that there is no need to fear instability as a result of this fact, but it clearly represents an added argument for increasing and improving the instrumentation and controls of this type of reactor to ensure prompt counteraction of any tendency toward a "runaway."

Canadian exhibits were missed

Canada's main contribution at Geneva was in the field of heavy water-moderated reactors, of course, and in methods of searching for and processing minerals. Canadian papers presented to the conference indicated that a great deal of progress had been made since the last meeting held in Geneva three years ago. Many delegates remarked, however, on the absence of Canadian companies in the very large commercial exhibition associated with the conference. While all the other "atomic powers" clearly regarded this exhibition as a fine opportunity to gain prestige and new clients, the only Canadian company that exhibited there was Rio Tinto. END

Ampex technician discusses details of one of their disc-tape stereo sets with am/fm tuner

Stereo sound catches interest of public

10,000 attend 1958 Montreal High Fidelity Exposition

PETER C. WHITEHOUSE, B.A., CORRESPONDENT

Forty-seven manufacturers of audio equipment put their products on display at the Dominion High Fidelity Exposition in Montreal, October 29 to November 1. More than anything else the show emphasized the faith the manufacturers have in the future of stereo sound. The record attendance of 10,000 people during the show's 4 days certainly seems to justify that faith.

Radio Station CFCF, a pioneer in the transmission of stereo broadcasts via am/fm, had two of Marconi's latest stereo players on show, plus an interesting exhibition of antique radio components used in their broadcasting station in the past. Mr. Bowden, chief engineer for CFCF, anticipates that the day is not too far distant when most stations will carry stereo broadcasts via am/fm or by fm transmission and multiplex detection. "It just has to come," he told me.

That manufacturers share Mr. Bowden's outlook seemed borne out by the number of stereo tuners on display. These included models by Fisher, EICO, Grommes and other leading makers. One Fisher model, the 101R, has separate am and fm sections, plus multiplex detection. It has a sensitivity (fm) of 1.6 mv for 20 db quieting; (am) 3.5 mv for 0.5 volts output. Frequency response is (fm) 20 to 20,000 cps, ±0.5 db; (am) —10 db at 7.5 kc in "broad" position and —10 db at 4 kc in "narrow" position. Signal to hum ratio is (fm) 60 db for 100 mv output. FM has 4 i-f stages, 2 limiter stages, agc interstation noise muting, and low-impedance output. AM has one tuned rf stage, 2 i-f stages, plus delayed agc. The set has 7 outlets with multiplex. This Fisher tuner sells for about $345.

An EICO fm multiplex tuner is available in either factory-wired or kit form. It is an efficient little set at a moderate price. It has a sensitivity of 1.5 mv for 20 db quieting, frequency response of 20 to 20,000 cps, ± 1 db. The i-f bandwidth is 260 kc at the 6 db points; detector bandwidth is 400 kc; maximum drift is 20 kc from cold start, and the hum is 60 db below one volt. Outputs are cathode followers to the amplifier and multiplex.

Combination disc and tape stereo systems, incorporating am/fm tuners convertible to multiplex, ranged from a massive Ampex set with a peak power output of 120 watts ($3,500) to a Seabreeze set selling at $1,895. In the lower-priced and less complex range were Seabreeze's Mark II console selling at $825, and Cossor's package stereo system selling at $299. The Seabreeze Century combination system was of particular interest because stereo enthusiasts can buy this system in stages. They can start with a speaker unit and record changer, later adding a cabinet with a 12-inch speaker. Still later they can add a stereo tape recorder and playback unit, plus another 12-

CFCF featured an exhibition of antique radio components

Electro Voice salesman describes their Ionovac tweeter

inch speaker cabinet, getting a complete stereo system for a total of about $639.

Cossor's package deal consists of two consoles with 8-inch universal impedance speakers fed by two 10-watt combined amplifier pre-amplifiers, each having separate controls. Frequency response is flat from 40 cps to 12,000 cps with an input level of 800 mv. The record changer is a Garrard Mk II.

Loudspeakers

Of the speakers and speaker systems, by far the most interesting on display were those of Electro Voice, EICO and Jensen. EICO speakers incorporate the old exponential flare concept first developed in 1919, a system which is claimed to provide the deepest, most efficient base extension per cubic foot. EICO speaker systems give a flat response from 45 to 20,000 cps with a useful range from 30 to 40,000 cps. They are the three-way type consisting of speakers, built-in cross-overs and balance control. An 8½-inch twin-cone driver, covering the 30 to 2,000, and 2,000 to 6,000 cps ranges, is rear loaded with a slotted end dual conical horn 12 feet long. The high-frequency unit is a nondirectional dual-cone toroidal driver with a free floating acoustically loaded cone. The treble assembly is located above the horn mechanism box. Rated impedance is 16 ohms with distribution being 180 deg. horizontal and 90 deg. vertical.

Jensen employs the stereo director system consisting of 2 cabinets each containing a base speaker facing downward to the floor. Mid and high ranges are covered by 3-way directional assemblies mounted above the cabinet and rotatable 360 deg. The Jensen SS 200 system consists of two 15-inch high-compliance woofers for response down to 16 cps, with directional systems consisting of an 8-inch upper base unit, compression-driven horn-loaded mid channel, and a phase-corrected tweeter unit. Cross-over frequencies are at 200, 400 and 4,000 cps. Impedance is 16 ohms, peak power 40 watts, and there are individual controls for both units.

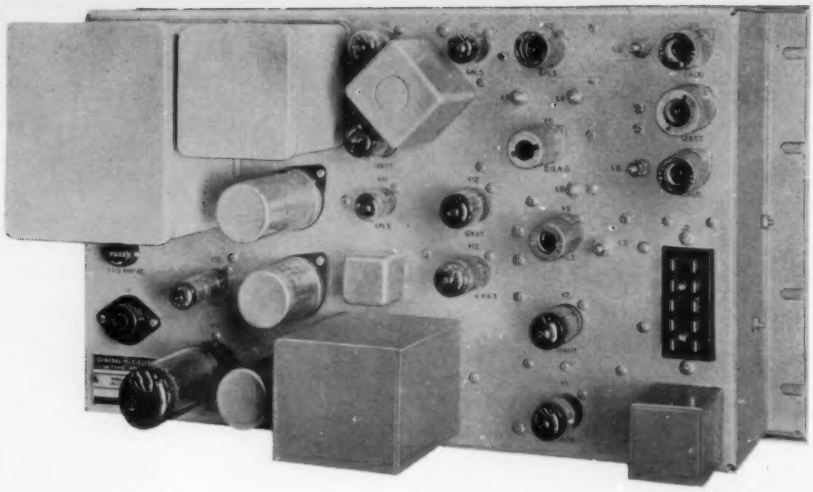
Electro Voice claim a performance equal to the best in stereo by the use of a special Stereon unit which eliminates the second base speaker and thus saves space and money. Based on the principle that frequencies below 300 cps are nondirectional, the Electro Voice Stereon diverts all bass from both channels to one full-range speaker system. Frequencies above 300 cps are handled by the tweeters and treble drivers in the two speaker systems, thus ensuring full directional handling of the higher ranges of sound. The Stereon control consists of matching transformer and cross-over network components to combine two channels.

Another interesting Electro Voice speaker was the Ionovac tweeter with sound being produced by application of rf current to ionized air. The resultant modulation of the ionization produces rarefaction and compression of the air at the mouth of the defraction horn, thus audible sound. The Ionovac has a capacity of 50 watts with 100-watt peak, frequency response from 2 kc to 40 kc, ± 2 db. The impedance is 16 ohms, sensitivity 60 db, radiation 180 deg and cross-over 3,500 cps.

Outstanding among record turntables was the Cossor Hi Fi turntable. This employs a lateral band drive operating a 16-lb precision turntable. The drive belt acts as a vibration isolator. The motor is mounted on floating bearings and insulated to avoid inducing hum in the pickup. The motor board incorporates a spirit level and four leveling screws to permit extreme accuracy of adjustment.

McCurdy Radio Industries Ltd. introduced their new HH-12 high fidelity turntable. It incorporates a hysteresis synchronous type of motor in which the armature is held stationary and the field coils rotate about it. With the outside of the motor driving in this way, high torque with good stability is achieved. The five-pound platter is machined from aluminum and driven by a neoprene idler wheel which is disengaged from the platter and the motor capstan when the control switch is turned off. It has the three standard speeds. **END**

Hi-Fi turntable shown by Cossor, with band drive, 16-pound platter and spirit level



How audio limiters increase coverage

R. W. NAYLOR, P.ENG.*

AM broadcast stations can increase their coverage by increasing transmitted power. An examination of what happens leads to the conclusion that a properly designed audio limiter, combined with a gain-adjusting device, can achieve the same results as far as the listener is concerned

The purpose of this article is to show why an audio limiter of the proper type can help to increase broadcast station coverage. It is surprising how little information exists in the literature on this subject. It is hoped that the material presented will fill this gap in the broadcasting art.

Before getting into the details of the limiting phenomena, a brief examination of the more conventional way of increasing coverage by boosting transmitter power may prove helpful. Suppose a 1 kw station on 1,000 kc puts out 3 mv at 10 miles. If the output power is increased to 5w the 3 mv contour will move out to about 15 miles.

1 kw, 1,000 kc—3 mv/m at 10 miles
5 kw, 1,000 kc—3 mv/m at 15 miles approx.

Now consider the situation from a different angle. John Doe lives 15 miles from the station in a busy area with lots of TV set interference. When the station was on 1 kw the signal strength at his house was about 1.4 mv per metre and the noise was just starting to become annoying, so he usually switched to another frequency. When the power was increased to 5 kw the avc in the receiver reduced the receiver rf gain but the audio output remained about the same. As a result the ratio of signal to noise had improved by about 7 db. Now John Doe listens to the station more.

*Formerly with Cdn. General Electric Co. Ltd., Toronto

Why was John Doe not a listener before the power increase, but a listener now? After all, a 7 db increase in signal to noise ratio is not much — or is it? Let us look behind the scenes at the technical aspect.

In an a-m broadcast system the peak audio signal at the receiver is determined by the amount by which the carrier is modulated. If we could modulate 100% all the time the noise at John Doe's house would be at least 30 db below the audio and he would be quite content. However, there are times when the modulation is as low as 10%. This is 20 db below 100% modulation and only 10 db above the noise level.

For 1 kw: 100% modulation — noise down 30 db
10% modulation — noise down 10 db

When power was increased the noise dropped a further 7 db

For 5 kw: 100% modulation — noise down 37 db
10% modulation — noise down 17 db

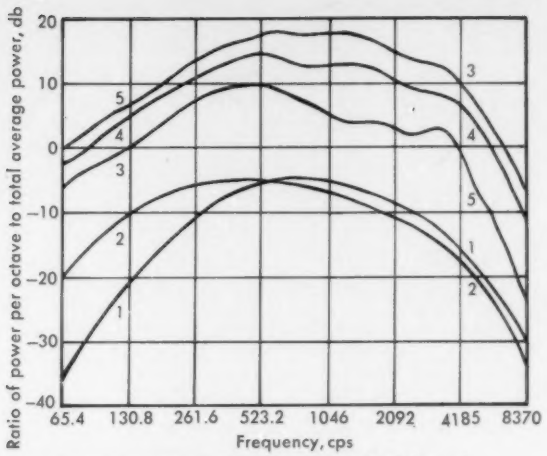
7 db on top of 10 db makes a big difference.

However, it is not always possible to increase power on a particular frequency. Let us consider sound and hearing and see if there is something else that can be done.

Sound and hearing

Figure 1 shows the relationship between the peak levels of speech and the average power. Note that if we only consider peak power exceeded in 10% of the intervals at 500 cycles there is about 13 db difference between peak and average. This means that under normal circumstances the average speech level would be equivalent to about 25% to 30% modulation. If taken for 1/8th second intervals the situation is still worse by about 5 db and if taken over long intervals the situation is about 10 db worse.

In music the peak average ratio is slightly less, running closer to 10 db than 13 db. This means that on music it is possible to run 30% to 35% average modulation



1. Average power 15 second intervals (Women)
2. Average power 15 second intervals (Men)
3. Maximum peak power in ⅛ second intervals (men)
4. Peak power exceeded in 2% of intervals
5. Peak power exceeded in 10% of intervals

Fig. 1

Variation of conversational speech power with frequency (After Sivian and Fletcher)

(Reproduced by permission from Radio Engineering Handbook by Keith Henney, copyright 1941 McGraw-Hill Company of Canada Ltd.)

level without difficulty. In passing it should be noted that this discrepancy between music and speech can be offset as far as male voices are concerned by polarizing the microphones.

So much for speech and music. Now let us consider the ear and its behavior. To a rough approximation it has been found that in the middle frequency range it behaves as shown in figure 2.

If 2 volts are fed to a speaker to give approximately 74 db above threshold, the difference in loudness between 1 and 2 volts of audio is almost negligible. Between 1 and 0.5 volts there is an almost linear relationship. Below 0.5 volts there is a tremendous increase in loudness for small increases in audio level. So this is one more fact that we can tuck in the back of our minds.

As well as looking at the input-output characteristics of the ear, we must also consider its frequency response. Figure 3 shows that the frequency response of the ear is much worse at low levels than at high levels. Hence if we are thinking about compressing audio in any way we should do it at the high levels rather than at the low levels.

There are the facts. How do we use them to get greater coverage? Let us look again at the input-output characteristics of the year (figure 2) and think of the input in terms of percent modulation.

If we could increase the modulation from 100% to 200% the apparent loudness would only increase 70%. Or to put it backwards, if a 200% modulated signal were available and in some way or other limited to 100% without changing the lower levels, the ear would hardly be able to tell the difference. Note the phrase, "without changing the lower levels," because it is in these lower levels that we are fighting the noise.

Methods of limiting

You will recall that we started out to discover a method of increasing our coverage by an amount equivalent to an increase in power from 1 kw to 5 kw, or voltage increase of $\sqrt{5}$. Let us put the facts together and see what they add up to. If in our present 1 kw installation we merely increase the audio gain by $\sqrt{5}$, as far as all the audio signals below 45% modulation are concerned we will have the equivalent of a 5 kw signal. That is, our signal to noise ratio at 10% modulation would be 17 db at John Doe's house. This is because John would have turned his volume down $\sqrt{5}$ and thus taken the noise down by that amount. What about the part over 100% that we will get with what is left? We have already seen that if we limit this to 100% the ear will not detect any appreciable difference between this signal and a 5 kw signal.

How about frequency response? Figure 3 shows that if any limiting or compressing is done at the low audio levels, the frequency response will be seriously upset. However, if limiting is confined to the upper area where the ear is fairly linear there will not be much adverse effect. Hence the ideal limiter should have a curve something like figure 4. Once the limiter is inserted and the audio gain turned up at the station, John Doe would immediately turn his volume down by an equal amount.

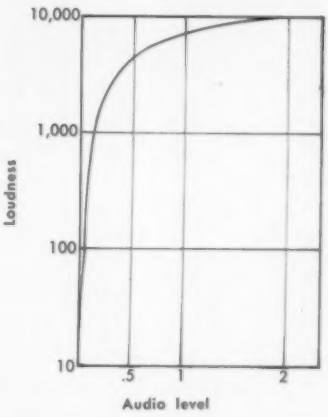


Fig. 2. Relationship between apparent loudness and audio voltage. Maximum level 74 db above threshold.

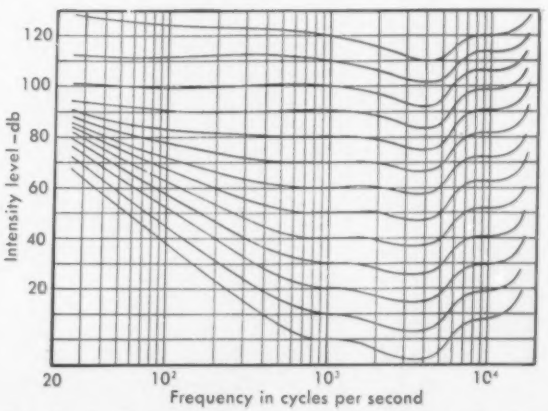


Fig. 3. Loudness level curves for normal ears showing the variation in sound intensity with frequency required to produce a sound judged to be as loud as that heard at the 1000-cycle reference frequency. 0 db = 10^{-16} watts per sq. cm = .000204 bars. (After Fletcher and Munson.)

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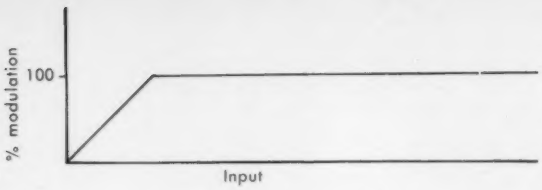


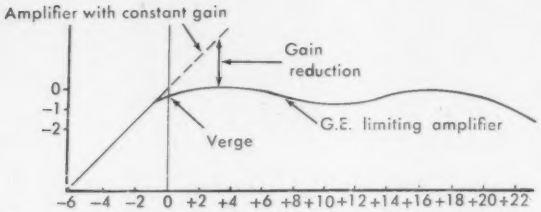


Fig. 4. (above) Desired characteristics of ideal limiter
Fig. 5. (below) Typical gain-adjusting characteristics of G. E. type BA-7-A limiting amplifier.

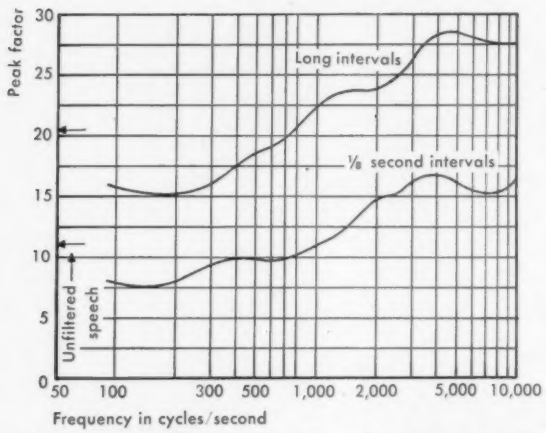


Fig. 6. Peak factor (ratio of peak/root-mean-square pressures) in decibels for speech in 1- and ½-octave frequency bands, for ⅛- and 75-second time intervals.

(Courtesy of the Journal of the Acoustical Society of America)

Front panel of G. E. type BA-7-A limiting amplifier. Rear view of the chassis appears at the head of this article.

This would reduce the noise and leave the signal at the same level as before. Figure 5 shows a curve of an actual commercial limiter which approaches the ideal.

Actually, in areas close to the station, 7 db of dynamic range is lost if the receiver is an expensive one. However, on cheap receivers or in areas a fair distance from the station, the limit on dynamic range is usually the noise level. Your customers will not leave you if you have reduced your dynamic range by a few db. However, they most certainly will go away if noise starts to become annoying. Hence the advantages of a limiter far outweigh the disadvantages.

The ideal type of limiter discussed here has an instantaneous attack time as well as limiting until almost 100% modulation level is achieved. There is also the so-called uni-level type of amplifier which is merely an automatic gain control to replace an operator riding the gain.

Figure 6 clearly illustrates the different uses of the two types of amplifiers. The ratio of peak to average over short intervals has been mentioned previously. Actually, if peak to average over long intervals is considered, the ratio is much greater (see figure 6). Around 500 cycles, where most of the energy is concentrated, the difference is almost 8 db. The automatic gain type of amplifier can take care of this difference quite nicely and allows you to run about 30% modulation continuously. The other type will enable you to run about 50-70% average modulation. By using both, a good dynamic range can be maintained, plus increased coverage.

The uni-level amplifier can also be used as a compression amplifier, but note that it limits to a certain extent at the low levels as well as the high levels, and the attack time is low.

The argument applied to a-m of course applies equally well to television sound. Here the noise you have to fight is intercarrier buzz. The more that average modulation can be increased without exceeding 25 kc swing, the happier your listeners will be. Incidentally, notice that in this case the limiter is the only answer to greater listener satisfaction. Increasing audio transmitter power would actully make the intercarrier buzz worse.

Conclusion

Station coverage can be increased by making more effective use of the modulated carrier. There are two steps necessary to accomplish this. The first is to maintain a good general audio level. This can be accomplished by an alert operator continuously riding the gain or by an automatic gain adjusting device. The second is by limiting the audio peaks in the region where the ear will find it difficult to tell the difference.

By combining the two you should be able to maintain an average of 67% modulation with a good dynamic range and frequency response. It is interesting to note that under this 67% modulation condition and sideband power for the 1 kw transmitter is equal to that of a 5 kw transmitter operating under normal conditions. END

Fig. 1. of "Pulse modulated beam current improves operation of mixer series klystrons" by A. K. Scrivens, CEE, October 1958, omitted to show the ground connection on the lower side of C_6.

CANADIAN ELECTRONICS ENGINEERING

Volume 2
1957

Index of technical articles

Classifications used in this index correspond to the Professional Groups of the Institute of Radio Engineers. Articles are arranged alphabetically under each classification.

For your library

Switching circuits are important to many electronics engineers

Switching Circuits and Logical Design

Samuel H. Caldwell. John Wiley & Sons, Inc., New York, N.Y.; 686 pp.; $14.

Reviewed by H. Ratz, P.Eng., Fischer & Porter (Canada) Ltd., Toronto.

This book presents the fundamental scientific methods behind the synthesis of switching circuits. The latter are defined generally to include all binary digital systems whether made of contacts, electronic or magnetic devices.

Switching circuits are encountered in computer, communication, data reduction and control systems involving two-valued decision functions based upon a specified logic. These range from simple interlocks of push-buttons and relays to high-speed electronic computers. This book develops methods based on analytic principles for the synthesis of circuits for such systems.

The basic concepts of switching algebra are presented to provide the mathematical language for the description of problems. For teaching purposes, the algebra is then interpreted as relay contact configurations, with which the principles and synthesis methods are illustrated for the design and minimization of combinational networks — including multi-terminal, symmetric and non-series-parallel contacts circuits. These techniques are then applied to electronic and solid state devices. There follows a discussion of the implications for logical design involved in the coding and error detecting of data reduction and communication systems. The last third of the text presents the methods of sequential circuit design which apply to systems including "memory" or storage elements such as relays or bistable electronic or magnetic devices.

This book will provide design engineers with an understanding of the scientific principles underlying switching circuit theory together with a library of synthesis procedures for attacking practical problems. There are numerous references to the literature and a wealth of practice exercises. Extensive use is made of examples and diagrams.

Hand in hand

Alfred L. Dowden, editor-chairman; Prof. E. W. Boehne, adviser; Gordon & Co., Publishers, West Medford 56, Massachusetts; 368 pp; $10 (U.S.A.)

"Hand in Hand" is the first book to tell the exciting story of selective co-operative scientific education in the United States—and what this revolutionary movement can mean to high-school students interested in science and engineering, to their parents, to industry and to educational systems.

It describes how actual work in the student's chosen field in industry can alternate with periods of college study to balance theory with experience and provide a broader base for success.

Buildings for Research

Written by the editors of Architectural Record; F. W. Dodge Corp., New York, N.Y.; 232 pp.; $9.50.

In this new book are surveys of 44 outstanding research facilities with covering commentary and photographs, plus additional longer text sections by men prominent in the field of research building design. Erected by industry, government agencies, universities, and branches of the armed forces, these research projects serve such diverse fields as communications, nuclear energy, textiles, chemistry, medicine, foods and petroleum products. As there can be no standard model for a research laboratory, each design is dictated by the operation it houses and each has incorporated the ultimate in flexibility to allow for inexpensive, rapid change-over as new discoveries blast old conceptions.

The material contained in this book should be of interest to architects, engineers, designers, research directors and all persons charged with planning and developing research facilities.

New books for engineers

The following new books have been announced by the McGraw-Hill Co. of Canada, Ltd., 253 Spadina Road, Toronto 4, Ontario.

The Preparation of Engineering Reports, by T. R. Agg and W. L. Foster; $4.60.

Recent Advances in the Engineering Sciences, by the Purdue Research Foundation; $5.70.

Practical Supervision, by Palmer J. Kalsem; $5.70.

How and Where To Look It Up, by Robert W. Murphy; $17.25.

Management For Engineers, by Roger C. Heimer; $8.10.

Mathematics for Science and Engineering, by Philip A. Alger; $7.75.

Sales and Engineering Representation, by L. O. Thayer; $6.90.

Logic Machines and Diagrams, by Martin Gardner; $5.75.

Engineering Economy, by C. E. Bullinger; $8.40.

Table for the Solution of Cubic Equations, by H. E. Salzer and C. H. Richards; $8.65.

Contracts, Specifications and Law for Engineers, by C. W. Dunham and R. D. Young; $9.00.

Physics for Science and Engineering, by R. L. Weber, M. W. White and K. V. Manning; $9.60.

How Much and How Many (facts on weights and measure), by Jeanne Bendick; $3.20.

Introduction to Nuclear Engineering, by R. Stephenson; $11.40.

Linear Programming, fundamentals and applications, by R. O. Ferguson and L. F. Sargant; $11.50.

Canadian Business Administration, a survey course, by L. W. Sipherd, W. A. Thompson and J. J. Wettlaufer of the University of Western Ontario; $7.15.

The Compleat Strategyst, being a primer on the theory of games of strategy, by J. D. Williams; $5.50.

Catalogues and brochures from the manufacturers

Manual of nuclear instrumentation for training, medicine, reactors, industry, monitoring and research, issued by Radiation Counter Labs. The 52-page book is available free (single copies) to users of nuclear instruments if they reply on company letterhead and state their position. Additional copies are $2.00 each. Electromechanical Products, Markham Road, Agincourt, Ontario.

Glennite strain gauge pressure transducers. This is a 4-page brochure on gauge, absolute and differential pressure measurements prepared by Gulton Industries. Lake Engineering Co. Ltd., Scarborough, Ontario. (101)

Carbon and graphite properties and uses is the title of a 56-page manual giving property, application and performance data on a wide range of carbon and graphite products. Canadian Stackpole Ltd., Toronto. (102)

Control reactors is a 28-page brochure containing design information, specifications and characteristic curves for control reactors, industrial transformers and precision filters. Chicago Magnetic Control, Chicago. (103)

Aluminum rf coaxial connectors. Catalog ALRF-1 provides full specifications for this new type of connector. Cannon Electric Canada Ltd., Toronto. (104)

People in the industry

(Continued from page 7)

Officer of Tiger Force Headquarters in England; Senior Equipment Officer, Torquay, England; Re-arming co-ordinator in London, England; Special Projects Officer at AFHQ (two tours); Commanding Officer of No. 5 Supply Depot, Moncton, and later No. 1 Supply Depot, Weston, Ontario; and Senior RCAF Liaison Officer with the Dept. of Defence Production.

Potter & Brumfield names production manager

Archie Robinson has been named production manager of Potter & Brumfield Canada Limited, in Guelph, Ontario, according to E. W. Gentz, the firm's director of manufacturing. The appointment of Mr. Robinson completes the Guelph production staff and represents one of the final stages in the company's plans to staff the new facility with Canadian personnel.

Bell names general defense co-ordinator

D. Newton Culver, of Toronto, has been appointed general defense co-ordinator of The Bell Telephone Company of Canada, with headquarters in Montreal.

In this newly-created post, Mr. Culver will be responsible for co-ordination of all defense activities within the company and with other members of the Trans-Canada Telephone System and the American Telephone and Telegraph Company, and for liaison with government and other agencies on such matters.

Culver

Little

Little promoted at Northern Electric

New general manager of the wire and cable division of the Northern Electric Company Ltd. is **J. G. Little.** He succeeds **W. H. Eastlake** who retired on October 31.

Mr. Little was born in Trenton, Ontario, received his early education there and graduated in engineering from the University of Toronto in 1928.

He joined the Northern Electric Company upon graduation and was successively engaged in various engineering capacities and, in 1942, was appointed technical superintendent in charge of manufacturing engineering in their telephone division.

In 1946 he was appointed works manager of their electronics division and in 1950 he was transferred from that division at Belleville, Ontario, to the wire and cable division, Montreal, as works manager.

Dept. of Transport promotes two

The promotion of **Harold R. Newcombe** to the position of Superintendent of Radio Authorization and Enforcement in DOT's Radio Regulations Division has been announced. He succeeds W. A. Caton who was promoted to Controller of Radio Regulations.

Most of Mr. Newcombe's career has been in radio. He joined the Department in 1928, first as a radio operator then radio inspector, technical officer and administrative officer. **W. R. Butler,** for the past 11 years Regional Radio Aids Engineer at Moncton, has been appointed Special Assistant, Telecommunications Branch and transferred to Ottawa for a period of two years. In the new position Mr. Butler will be the representative of the Telecommunications Branch to the Emergency Measures Organization of the Privy Council.

Field Aviation adds Ottawa rep.

A. G. Duguid, manager of the Agency and Distribution Division of Field Aviation Company Limited, Oshawa, Ontario, announces that **Charles Fox Pearce** has joined the division as special technical representative. Mr. Pearce will be located at 857 Bank Street, Ottawa.

At Field, Mr. Pearce will be responsible for technical representation for G. Q. Parachute Company and Ultra Electric Company, two U. K. firms whose products are used extensively by the RCAF.

Company expansion brings promotions

Expansion of the technical services of George Kent (Canada) Ltd. has resulted in one promotion and the addition of new staff members. **Peter Hooper** has been appointed sales manager. Mr. Hooper had five years' experience in Canada as technical sales representative with this company, preceded by one year in England.

Two technical sales representatives have been added to the staff. **Maurice Stretton** will service the Toronto and Hamilton areas and **Denis Tizard** will be responsible for the London, Windsor, Sarnia district. **Bill Kipling** is now projects manager and is in charge of planning and developing projects.

Oakley heads semiconductor sales at CGE

Recently appointed sales manager —semiconductor products in Canadian General Electric's Electronic Tube Section is **John R. Oakley,** P.Eng.

Since joining CGE in 1954, Mr. Oakley has held important assignments in defense activities. In 1954 he worked as a development engineer on the APG-501 airborne radar set used in RCAF Sabre aircraft. Later he served in Europe as a technical representative for CGE to the RCAF.

In 1957 he returned to Canada and joined an advance engineering team working on the development of data link equipment. His final assignment before joining the Electronic Tube Section was in the development of ultra low frequency oscillator equipment for the RCN.

Oakley

Obituary

Frank R. Deakins, chairman of the board, RCA Victor Company Ltd., died Nov. 4 at his son's home in Valley Forge, Penn., after a lengthy illness.

Born in Jasper, Tenn., Mr. Deakins was educated at the Alabama Polytechnic Institute. After a number of years with the Radio Corporation of America, Mr. Deakins joined RCA Victor in Canada as vice-president in 1932. In 1944 he was appointed president and in 1956 chairman of the board.

Sales engineer for Westinghouse tubes

The appointment of **Earl Smith** as sales engineer for the Electronic Tube Division, has been announced by the Canadian Westinghouse Company Ltd.

He has been with the company since 1943 and has served in various capacities in the tube plant. He will be responsible for the tube sales engineering function on industrial, transmitting and special purpose tubes as well as semi-conductors.

In the past 15 years he has worked up through the ranks before being appointed sales engineer.

Defense contracts

Unclassified electronics contracts for $10,000 or more have been awarded to the following Canadian firms by the Department of Defense Production. A number in parenthesis indicates that the amount is the total of that number of contracts.

September 16-30 1958

Amalgamated Electric Corp. Ltd., Ottawa, telephone cable, $19,409.

Beaconing Optical & Precision Materials Co. Ltd., Montreal, fire control equipment, $27,469.

Bell Telephone Co. of Canada, Ottawa, technical services, $18,251.

Collins Radio Co. of Canada Ltd., Toronto, repair and overhaul, $25,000; development, $35,374; instruments, $109,391.

Computing Devices of Canada Ltd., Ottawa, radiacmeters, $28,826 (2).

Delta Aircraft Equipment Co., Toronto, equipment, $57,185.

Measurement Engineering Ltd., Arnprior, Ont., 'scopes, $91,480 (3).

Northern Electric Co. Ltd., Ottawa, components, $36,651.

Sperry Gyroscope Co. of Canada Ltd., Montreal, test equipment, $27,405; tubes, $13,481.

Varian Associates of Canada Ltd., Georgetown, Ont., tubes, $18,653.

October 1-15, 1958

Canadian Aviation Electronics Ltd., Montreal, tech. services, $175,822.

Canadian General Electric Co. Ltd., Toronto, tubes, $14,080.

Canadian Marconi Co., Toronto, tubes, $34,298.

Canadian Westinghouse Co. Ltd., Hamilton, equipment, $15,000.

C. P. Clare Canada Ltd., Toronto, relays, $13,417.

Computing Devices of Canada Ltd., Ottawa, multiplexing equipment, $12,291.

E.P. Electric Products Co. Ltd., Montreal, installation of radio facilities, $90,448 (2).

Northern Electric Co. Ltd., Ottawa, communication equipment, $36,164.

Philips Electronics Industries Ltd., Toronto, technical services, $13,326.

Raytheon Canada Ltd., Ottawa, tubes, $225,386.

Sparton of Canada Ltd., London, sonobuoy transmitters, $1,070,392.

Sperry Gyroscope Co. of Canada Ltd., Montreal, aircraft navigation equipment, $43,322.

Standard Telephones & Cables Mfg. Co. (Canada) Ltd., Montreal, equipment, $47,123.

T.M.C. (Canada) Ltd., Ottawa, teletypewriter sets, $ 18,030; radio transmitters, $15,056.

Scientists review progress of particle accelerators

Two hundred and eighty-five scientists from the United States, Canada and five other countries assembled in Cambridge, Massachusetts, last month for a three-day Accelerator Conference. It was sponsored by High Voltage Engineering Corporation to satisfy the pressing need for a new interchange of ideas on particle accelerators and their uses.

About twelve Canadians attended the conference, including Dr. W. B. Lewis, Vice-President, Research and Development, Atomic Energy of Canada Ltd., and Dr. E. Almqvist, Physics Division, AECL.

Dr. Lewis delivered the banquet speech, while Dr. Almqvist read a paper on He^3 Energy Levels and Recovery Systems, at the session on Nuclear Physics.

The conference was divided into three main sessions—Nuclear physics, Radiation research, and Electron processing. In addition to this, the delegates toured the premises of High Voltage Engineering Corporation in Burlington.

Dr. Lewis, in his speech, presented a very realistic appraisal of conditions affecting research projects in Canada. Specifically, he was discussing factors involved in the purchase of the new tandem Van de Graaff accelerator when he made these remarks . . .

"It is not easy to get money in Canada except with the promise of rather immediate returns . . . How then did we get the first tandem? We have established a very strong belief that we lead the world in the approach to low-cost nuclear power. This position is reached by very careful 'sharpening of our pencils' to use a current industrial phrase.

"We plan to extract 8,000 or more megawatt days from a tonne of natural uranium without any reprocessing. Few as yet understand this, but it rests on direct experiment. To achieve the most demands accurate knowledge, the results of accurate measurements of many quantities including the properties of uranium, plutonium and the fission products.

"Vaguely similar processes happen in the interior of stars. By studying these Dr. Alastair Cameron at Chalk River found that by developing a theory started by Dr. T. D. Newton (also of Chalk River) he was able to calculate the exact masses of nuclei high in the periodic table, accurate to 300 keV. We need, however, better accuracy, and this is where the tandem comes to our aid. The ions it accelerates will have sufficient energy (precisely known) to penetrate heavy nuclei. What the results will be and of how much use, is an open question. Whether it will amount to 0.01 mill/kw hour, or more, or less in the cost of nuclear power we cannot now know. Where there is ignorance there is fear. With the knowledge to be gained from the tandem, we shall understand."

At the Accelerator Conference Dr. W. B. Lewis delivered the banquet speech. On right is Dr. D. M. Robinson, president, High Voltage Engineering Corp.

International atomic scientific committee

A Scientific Advisory Committee has been appointed by the International Atomic Energy Agency (IAEA). The committee's function is to provide the IAEA board of governors and the Director-General with advice on scientific and technical questions arising out of the Agency's program.

The seven members of the committee, appointed November 4, are: Dr. Homi J. Bhabha, India (subject to the concurrence of the Government of India); Sir John Cockcroft, United Kingdom; Professor V. S. Emelyanov, USSR; Professor Bertrand Goldschmidt, France; Professor Bernhard Gross, Brazil; Dr. W. B. Lewis, Canada; Professor I. I. Rabi, U.S.A.

Announcing the appointments, the Agency stated in Vienna that membership of the IAEA Scientific Advisory Committee is identical with that of the United Nations Advisory Committee on the Peaceful Uses of Atomic Energy. "It is expected that this fact will further strengthen the relationship between IAEA and UN."

AEC staff appointments

The U. S. Atomic Energy Commission has announced the following staff appointments.

John A. Hall as Assistant General Manager for International Activities. Mr. Hall has been serving as Acting Assistant General Manager for International Activities since last June. Previously he had been Director, Division of International Affairs.

Algie A. Wells as Director, Division of International Affairs. Mr. Wells has been Deputy General Counsel, Office of the General Counsel.

Clark C. Vogel as Deputy Director, Division of International Affairs. Mr. Vogel has been Acting Deputy Director, Division of International Affairs.

Isotopic standards

The National Bureau of Standards in co-operation with the Atomic Energy Commission has prepared the first of a series of uranium isotopic standards for use by educational and research institutions and industry in the United States and abroad.

Ten standard uranium isotopic samples became available from the Bureau on October 1, 1958. Five additional uranium standards are in preparation to complete a series of fifteen.

The ten standards which became available from NBS on October 1 represent the first results of the AEC-NBS co-operative program. These will be at levels (weight per cent U-235) of 0.5, 1, 1.5, 2, 3, 5, 20, 85, 90, and 93. The five additional standards to be made available later will be at levels of 10, 15, 35, 75, and 80. A natural uranium chemical standard available October 1, will round out the uranium series.

Each isotopic standard issue unit will consist of a quantity of uranium oxide (U_3O_8) equivalent to one gram of uranium. The chemical standard issue unit will consist of 25 grams of uranium oxide. Charges will vary from about $18 to about $40 per issue unit depending on the enrichment level. A list of charges for the standards will be available from the National Bureau of Standards.

Orders from foreign sources should be submitted to the Division of International Affairs, U. S. Atomic Energy Commission, Washington 25, D.C.

Tape recorder-playback accepts half or quarter inch tape

First public demonstration of the new Presto tape recorder-playback Model R-850 took place Nov. 9 when Edgard Varèse, noted avant-garde composer, used the machine to present his "Electronic Poem," which was the musical sensation of the Brussels Fair.

Model R-850 uses a ½-in. tape with three tracks, and allows for instant convertibility to ¼-in. tape width, the only machine on the market with this convenience.

With a guaranteed speed accuracy of plus or minus three seconds per 30 minutes, the tape transport at maximum speed will rewind a 10½-in. diameter reel in approximately 55 seconds. Frequency response extends from 40 to 15,000 cycles, and flutter is below .15%. Signal-to-noise ratio is minus 55 db.

Bogen-Presto Div. of The Siegler Corporation, Paramus, N.J. (105)

Magnetic clutches

Miniature magnetic clutches for electrical control of servo system rotary mechanical functions can now be ordered off the shelf for immediate delivery. Two lightweight, compact models are available. Beckman Model 583 is suited for small space applications since it is only 1¼ in. in diameter and 2-11/16 in. long. For more rugged duty there is Model 543, 1¾ in. in diameter and 4⅛ in. in length.

Both models are the dry-disc, fixed-coil type of solenoid controlled clutches which use no slip rings. Inputs of 24 or 48 volts may be specified.

R-O-R Associates Ltd., Don Mills, Ontario. (106)

Electronic scanner

Maintenance of process stability and close reproduction of operating conditions are advantages of an electronic scanning instrument recently introduced to the petrochemical industry.

This digital variable indicator and temperature monitoring system scans the large numbers of thermocouples at a rate of five per second and determines when any exceed preset common off-normal set point or a preset common alarm set point.

If the first setting is exceeded, the time and identity of the off-normal point is recorded on an adding machine-type printer. If the second (higher) setting is exceeded, the system shuts down the plant, ensuring safety.

The system also has a digital display panel so that the thermocouple inputs can be programmed through an analog-digital system and be viewed at the panel. In this manner digital trends may be observed at any of these points.

The system employs the ramp or sweep voltage method of conversion whereby the amplified input voltages are compared to a generated voltage which rises linearly with time. The time consumed to rise from 0 to the unknown input voltage determines the number of counts transmitted to storage and, subsequently, displayed.

Hagan Corp. (Canada) Ltd., Toronto. (107)

450-mc pre-amplifier for two-way radio

Owners of two-way radio base stations who have difficulty hearing messages transmitted from cars to their headquarters can improve office reception with a new 450-mc pre-amplifier unit. It increases sensitivity of the receiver at the office location. This has the effect of improving the effective talk-back range of mobiles associated with the system without the necessity of adding equipment to the radio unit in the car itself. However, the pre-amplifier can be used in the car if desired.

The equipment also serves as an antenna matching unit and permits as many as four receivers to be used on one high-gain antenna. This reduces antenna costs and helps solve the lack of availability of adequate antenna sites in some locations.

One of the keys to performance of the new equipment is a low-noise ceramic receiving tube. This tube, No. 7077, is particularly suited for use where a high level of performance is required under severe environmental conditions and meets the dual requirements of low noise and high power gain.

Canadian General Electric Co. Ltd., Toronto. (108)

Magneto-resistive components

A new electronic component based on the solid state magneto-resistive effect exhibits an electrical resistance which is a function of an applied magnetic field. The new component, called a magneto-resistor, can be used to provide a low noise variable resistance without moving parts. It has a fast response time.

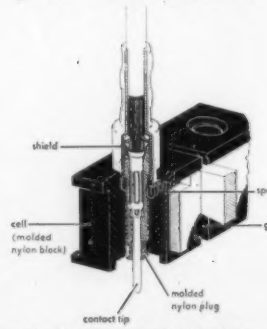
Ratios of high field resistance to zero field resistance of greater than 40 to 1 have been achieved. Magnetoresistors with a zero field value ranging from 0.01 ohms to 50. ohms are being developed now by Ohio Semiconductors, and are expected to be available in production quantities within a few months. Power dissipations of up to 100 watts are anticipated.

Ohio Semiconductors, Inc., Columbus, Ohio. (109)

Patchcord programming system

To prevent current leakage from one circuit to another, engineers of AMP Inc. have developed a new type of cellular construction using close tolerance molded nylon "blocks." Produced by a single-cavity automatic injection-molding technique, these units are supplied by Gries Reproducer Corp.

The new AMP programming system is constructed of molded nylon blocks alternated with interlocking metal strips. This cellular system of construction prevents current leakage from one circuit to another, while providing the strength advantages of a metal patchboard. Each



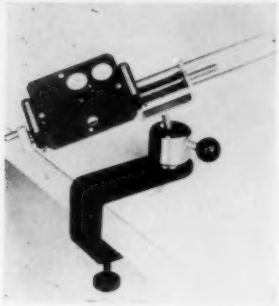
nylon block has a molded-in hole, so that standard patchcords, coaxial patchcords or special shielded patchcords can be inserted. This construction permits individual hole layout and color coding to meet individual requirements.

Gries Reproducer Corp., New York, N.Y. (110)

Holders aid production

A portable, fully-adjustable Tronic-Vise and Card-Holder designed to hold printed circuit boards and small sub-assemblies for maximum accessibility to either side is now being distributed in Canada.

Constructed of heavy-gauge steel, cadmium plated, this equipment holds units firmly but gently, freeing both hands for easy assembly. A hard, corrosion-proof plastic ball housed in an aluminum socket locks in any position through 90 degrees.



The Tronic - Vise, with rubber - lined jaws and speed knob, opens up to 6½ inches. The Card-Holder is adjustable, and will take printed circuit boards from three to 10 in. wide and up to ⅛ in. thick.

Available also is a fully adjustable, portable universal fixture designed to hold all standard chassis up to 30 in. square. The Tronic-hold T-300 can support chassis weighing up to 200 lb.

W. R. Watkins Co. Ltd., Toronto. (111)

10 mc to 44,000 mc spectrum analyzer

The new microwave spectrum analyzer model SPA-4 developed by Panoramic Radio Products, Inc. covers frequencies from 10 mc to 44,000 mc with one tuning head.

Resolution is continuously variable from 1 kc to 80 kc for analysis of wide and narrow pulsed RF signals. A sweep width of 70 mc, which is continuously adjustable down to 0 mc, makes possible wideband observation of the over-all frequency range of interest or high resolution analysis of small segments. Careful shielding avoids interference. Amplitude scales are calibrated for both voltage (linear) and power (square) as well as log. An accurate direct reading linear slide rule dial lights up band in use.

It may be used for the analysis of fm, am and pulsed systems, instabilities of oscillators, noise spectra, detection of parasitics and studies of other signal sources.

Panoramic Radio Products, Inc., Mount Vernon, N.Y. (112)

Fibre glass antennas

New omnidirectional high gain fixed station antennas for use in the 150 and 450 megacycle bands have been announced by Dielectric Products Engineering Co. Inc. Named the "Heliphase" Line, these epoxy-bonded fibre glass antennas feature a new type of feed system which reduces internal loss and improves electrical performance. VSWR is less than 1.5 to 1 for all models, which are available with a gain of 5.5 db at 150 mc, and 5.5, 7.5 and 10 db in the 450 mc band.

Dayrand Ltd., Montreal. (113)

Constant speed motor

Speed accuracy of better than one part in 20,000 is claimed for this miniature battery-operated dc motor. It uses a pm magnet rotor and a highly efficient field configuration, which is the coil arrangement of a transistor oscillator that is normally quiescent. A disturbance of the rotor induces a signal in a pickup coil that is amplified by the transistor increasing the base current thus driving the transistor to saturation. This is due to feedback from the emitter-collector coil. The current pulse so generated plus the inertia of the rotor produces and maintains rotation. Motors using as little as 130 microwatts have been built with the maximum size largely limited by the rating of available transistors.

Park Products Co. Inc., Cleveland, Ohio. (114)

High-speed motion analysis camera

Providing high-speed motion-analysis photographs at an upper rate of 25,000 16-mm frames per second, the new Beckman & Whitley Dynafax camera extends the range of previously recordable subject matter. A lightweight completely portable instrument, the Dynafax is arranged for simple, fast film processing, using standard 35-mm film.

Other features of the Dynafax camera include a stable framing rate during the operating cycle which is continually indicated on a built-in meter; absence of synchronizing requirements; exposure times easily adjustable between one and five microsecond at the maximum rated framing speed of the camera; total writing time of 9 millisec at 25,000 frames per second; adaptability to the use of any 16-mm cine lens in a "C" mount.

Requiring no external equipment beyond a common type of variable transformer, the Dynafax camera is 12 in. in diameter by 10 in. long over-all and weighs 28 lb. It is arranged for operation on any tripod having a standard mount.

Beckman & Whitley, Inc., San Carlos, Calif. (115)

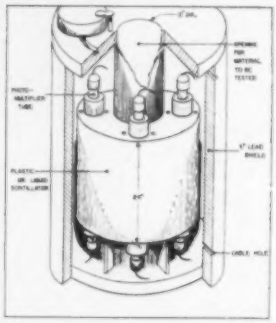
Reserve-power time switch

Tork's reserve-power time switch requires no winding and will maintain operation during power interruptions. Reserve action is provided by a powerful spring, electrically wound by the time switch. A special release mechanically exercises the reserve spring daily. The spring will continue to operate the timer for 17 hours without electric power. It is fully rewound in two hours by the a-c motor.

Dominion Electric Manufacturing Co. Ltd. (116)

Ratio computer for radiation measurements

This ratio computer, a scintillation detector of 4 pi geometry, has been designed to operate at extremely low radiation levels. Combined with either a single or multi-channel analyzer, the computer determines the energy level of radiation; identifies the radioactive isotope, and measures the amount. A counting time of only 100 seconds per subject is required to obtain a sensitivity of 5 x 10^{-10} curies for 1.5 Mev gamma rays.



Electromechanical Products, Agincourt, Ont. (117)

Dual voice coil woofer

Because there is no sense of direction obtained from frequencies below 150 cps, one woofer and its enclosure can reproduce the full combination of the bass information from both channels of a stereo system.

The new "stereo-ready" 12-in. woofer, model C-12SW connects to a limited range second channel speaker without the need for an isolation network or control filter. The speaker uses a 1½-lb Alnico 5 magnet. Dual voice coils are located on a single woofer suspension and all terminals are brought out to binding posts so that the speaker may be used either for monophonic or stereo operation. Response is 40 to 6,000 cps with a built-in adjustable response limiter that can be set for 700, 500 and 5,000 cps cut-off to suit the crossover requirements of the tweeter. Power rating is 25 watts and the impedance is eight ohms.

University Loudspeakers Inc., White Plains, N.Y. (118)

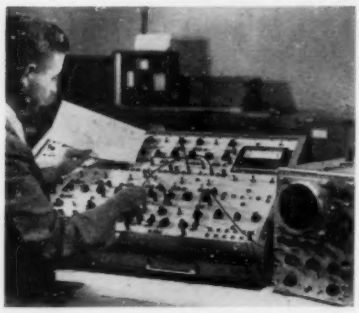
(Continued on page 45)

Synthesizer aids in design of transistor circuits

The transistor circuit synthesizer enables designers to check the performance of contemplated circuit designs. The instrument has four independent panels, each a transistor stage, and a master metering panel. By combining two or more transistor panels through wires or plug-in shorting bars, circuits can be assembled.

Either pnp or npn transistors can be employed in the circuits. A floating battery power supply is contained within the cabinet, and the negative, positive, or in-between taps can be selected as ground reference.

A feature of the metering panel is the curve tracer which can be used with an external oscilloscope to provide a visual display of the plot of the collector voltage versus collector current.



National Electronics Laboratories, Inc., Washington, D.C. (119)

New range of marine radar

The Decca D7 series marine radar consisits of seven radar sets. Each one is planned and designed to fulfil a need depending upon the requirements of any given ship. These seven new sets include two new true motion marine radars which embody many improvements based upon the TM.46 system. The D7 series consists of the following:

Model	Display	Mile range	kilowatts
303	9″	36	10
404	9″	48	20
505	9″	48	75
606	12″	48	20
TM707	12″	48	20 true motion
808	12″	48	75
TM909	12″	48	75 true motion

Decca Radar (Canada) Ltd., Toronto. (120)

Low frequency decade oscillator

The frequency range of Model D-880-A two-phase low-frequency decade oscillator is 0.01 cps to 11.2 kc. Over the whole of this range the output is constant within ±1 db.

The principle of operation is that of solving a second-order differential equation with damping by using two integrator stages and a sign changer. More simply, the over-all phase shift of 360 deg which is required for oscillation to occur is achieved by two electronic integrating circuits—each having a phase shift of 90 deg—and a sign changer circuit having a phase shift of 180 deg.

Two outputs—90 deg apart—are taken from the integrator circuits and are available at a level of 10V. Both outputs are directly coupled and the dc content is adjusted to a very low value by preset controls. The "0-deg output" is suitable for feeding into a load of 600 ohms and is adjustable by an output attenuator down to —62 dB ref 10V; the 90-deg output is suitable for a load of 10k ohms and is adjustable down to zero by means of a potentiometer.

Muirhead Instruments Ltd., Stratford, Ont. (121)

Standard frequency multipliers

Accurate measurements of microwave frequencies are facilitated by use of the new General Radio Type 1112 Standard Frequency Multipliers with a crystal-controlled frequency standard. These multipliers generate sine-wave signals of 1, 10, 100, and 1,000 megacycles and greatly extend the useful range of conventional frequency standards such as the GR Type 1100-A. The instruments are characterized by low noise and by almost complete freedom from sub-multiple-frequency spurious signals. In addition, the phase stability of the output signals is maintained at a high value.

The multiplier chain consists of two units, the first providing 20 milliwatts at 1, 10, and 100 megacycles from three phase-locked quartz-controlled oscillators; the second, 50 milliwatts at 1,000 megacycles from a phase-locked klystron oscillator. The input to the first unit, the Type 1112-A, is normally 100 kilocycles, but alternatively, 1, 2.5, or 5 megacycles can be used (when 2.5- or 5-megacycle input is used, the 1-megacycle output cannot be used). The second unit, Type 1112-B, is driven from the 100-megacycle output of the first unit.

General Radio Co., Toronto. (122)

Transistorized power supplies

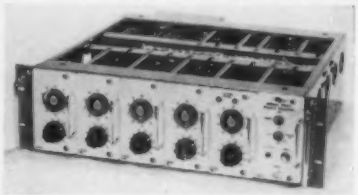
Universal Transistor Products Corp. transistorized power supplies for communications and navigation applications provide built-in protection against the spikes and transients disturbing system voltages in air-ground systems as described in MIL-E-7894A.

Model No. 6073 is a replacement for DY-103, the dynamotor for the ARC 34 transceiver, which features protection against input polarity reversal and short circuits as well as control of over-voltage. Plug and mounting facilities are designed for simple mount-to-mount replacement of elecro-mechanical supplies. Operating efficiency is 87%. Size is 6¼x3½ in. diameter. Weight is 2 lb. 12 oz. It produces 300V and 100V from 27 vdc input. The supply operates in temperatures from —40 C to +80 C. Other models are available with inputs from 6-110 vdc and outputs to 2,000 watts.

Conway Electronic Enterprises Reg'd., Toronto. (123)

Preset electronic counter

Printed circuit plug-in modules serve as separate counting decades and functional block units in a new line of electronic counting equipment. The series



includes two, three, four and five digit preset counters, dual preset counters and totalizers. The five decade preset counter model 7250C, illustrated, operates to 100 kc as a counter and will recycle without missing counts at rates to 5 kc.

The instrument features high input sensitivity, pulse and variable duration or locking relay contact output, and provision for electronic or switch gating of the input.

Electro-Pulse, Inc., Culver City, Calif. (124)

Shield for data storage tube

Magnetic Shield Division offers a new non-shock sensitive non-retentive dual laminae Netic Co-Netic shield which results in improved resolution thereby attaining maximum storage capacity in data storage tubes by diverting damaging magnetic fields which otherwise would seriously affect low velocity and multi electron beam arrangements. Both ac and permanent magnetic fields are effectively shielded at all operational levels.

This permits positioning other components directly adjacent to the tube without affecting it, minimizing space problems created by the necessary complexity of associated circuitry.

Magnetic Shield Div., Perfection Mica Co., Chicago. (125)

(Continued on page 46)

New products — cont.

Switch has magnetic hold-in

A completely sealed, momentary-action toggle switch that can be converted to a maintained-contact switch by means of a built-in solenoid has been developed by Micro Switch.

The precision single-pole double-throw switching unit and a 28 vdc solenoid are contained in an environment-proof unit measuring slightly over three inches from the top of the toggle lever to the bottom of the case. Diameter of the case is one inch.

The switch may be wired either normally-open, normally-closed or double-throw. Environment-proof magnetic hold-in switches are rated at 4 amperes, 28 vdc, resistive load. They are available with either wire leads or side-facing screw terminals.

Honeywell Controls Ltd., Toronto.
(126)

Axial lead rectifier

A new high-voltage silicon rectifier series has operating characteristics up to 1,500 volts and 100 ma at 150 deg C ambient temperature. Transitron's SL715 (100 ma) and SL615 (50 ma) are high-temperature rectifiers that combine high voltage and current ratings with the convenience of axial lead mounting. This device may be used in power supplies for megnetrons, Klystrons, electronic precipitators and other applications requiring 600-volt output or higher.

Adams Engineering Ltd., Montreal.
(127)

Delayed pulse and sweep generator

The new Dawe Instruments pulse generator has been designed to cover a wide range of pulse work. It provides these main facilities: (1) A pre-pulse or fixed width and amplitude. (2) The main pulse of variable width, amplitude and polarity delayed on the pre-pulse by a

variable time. (3) A negative going sawtooth (sweep) coinciding with the main pulse. (4) A cable formed pulse derived from the main pulse.

Cossor (Canada) Ltd., Toronto. (128)

Axial blower units

A series of tube axial blower units has been designed specifically for cooling electronic panels in computers, radio and television broadcast units, military electronic equipment, and other communications systems. The basic blower unit is 6 in. in over-all diameter, 4 in. long, weighs 16 oz., and can deliver from 50 to 160 cfm. Variations in unit size and air output can be made, and the motor may be either ac or dc.

The Torrington Mfg. Co. of Canada Ltd., Oakville, Ont. (129)

Non-contacting lineal measuring system

This non-contacting lineal measuring system has been developed for the measurement of lineal feet of ferrous strip material passing a fixed point.

The system will record distance (footage) in an 8 to 1 dynamic range of operating speeds with a degree of accuracy of better than 0.1% in its dynamic range. This degree of accuracy is due primarily to an electronic servo system which is used to compensate for variation in magnetic distances between pulses due to inherent delay in the electrical system and variations in running speeds of the plate being measured.

The measurement system operates on the principle of magnetic recording. An initial impulse is applied to a "recording" transducer which creates a magnetized area on the tin plate.

The unit is calibrated to operate in the speed range of 300 to 2,400 ft per minute (tin-plate line speed). Higher ranges can be supplied upon request.

Designers for Industry, Inc., Cleveland, Ohio. (130)

Direct reading torque meter

The F.B.A. Torque Meter is designed to read directly in in.-oz. of torque, the torque required to start a load and/or the torque required to maintain given rotational speeds.

Typical torque requirements may be measured in increments of .25 in.-oz. from .5 in.-oz. to 12 in.-oz. for the Model HC-100 unit with accuracies of plus/minus 3% independent of speed, up to 10,000 rpm. Other models are available, such as the HC.400, rated from .5 in.-oz. to 32 in.-oz. at 5,000 rpm.

Found Brothers Aviation Ltd., Malton, Ont. (131)

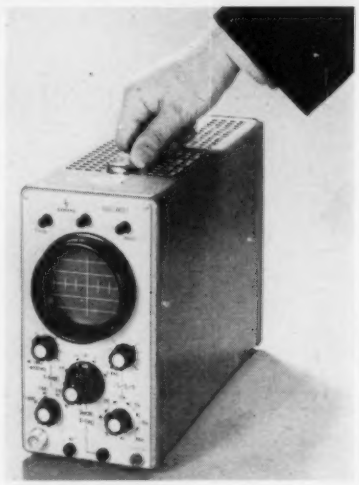
(Continued on page 48)

Portable oscillograph

The Siemens Oscillarzet, a new portable electronic oscillograph, is now available in Canada. It is designed for use in laboratories and workshops, and for radio and TV servicing.

Despite its unusually small casing (5 in. x 9 in. x 13 in.), the Oscillarzet incorporates a large three-inch screen for a clear, easy-to-read picture of measurable electrical and electronic impulses. Another feature is a newly-designed electron beam tube and a Y-X deflection system. The Y-amplifier broadband covers from 3 cps to 4 mc.

Ahearn & Soper Co. Ltd., Ottawa. (132)



Tandberg tape recorder

The new model 3-Stereo tape recorder includes three features not available on previous models. These are: base switch which provides 12 db of base boost at 70 cps; an automatic tape stop at the end of the reel; new deposited carbon, low noise resistors at critical points in the amplifier to obtain improved signal to noise ratio, and easier servicing.

An accessory unit now available is the model 241 stereo record-preamplifier. It includes a magic eye level indicator, level control, equalization switch, microphone input and radio-phono input. With this preamplifier the model 3-Stereo recorder is capable of recording stereo programs on any of the three following speeds; 1⅞ ips, 3¾ ips, 7½ ips.

The new 4-track stereo head model 529 can be specified for the model 3-Stereo recorder to permit the use of a standard or half track stereo tapes. The frequency response with these new 4-track heads is as follows: at 1⅞ ips, 30 to 5,000 cps ± 2 db; at 3¾ ips, 30 to 10,000 cps ± 2 db; at 7½ ips, 30 to 18,000 cps ± 2 db.

Engineered Sound Systems Ltd., Toronto. (133)

Shaft position to digital encoder

Multi-positional reporting can be accomplished with the Librascope's 10-bit shaft position-to-digital encoder. The over-all size of the encoder is 4 3/16 in. diameter by 1¼ in. thick. The shaft is fitted with a synchro-type mount to facilitate precise location of the input shaft. Voltage requirements for the transistors are 6 volts dc. Life of more than one million resolutions can be expected with an input shaft speed of up to 25 rpm. The instrument will operate over a temperature range of —50 to +150 F. The 10-bit resolution is obtained with a 3½-inch disc that yields 1,024 discreet position representations per turn. Control of the transition is accomplished by the combination of disc pattern and a 5-transistor logic circuit contained in the encoder.

Canadian Applied Research Ltd., Toronto. (134)

Microwave test equipment

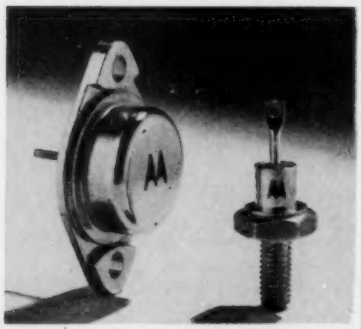
A complete line of electronic test equipment for the measurement of impedance, attenuation, and other microwave properties within the millimeter waveguide ranges has been developed by the Narda Microwave Corp.

Specific equipment in K, V, Q, M, and E Bands which is now available includes variable waveguide attenuators, tuneable waveguide detectors, high directivity directional couplers, impedance meters, vswr amplifiers, terminations, E-H tuners, frequency meters, and waveguide clamps and stands.

MEL Sales Ltd., Arnprior, Ont. (135)

Zener regulator diodes

Silicon zener regulator diodes are available in both 10- and 15-watt ratings with voltage ranges up to 200 volts. The 10MZ series which is rated for 10 watts at 55 C is housed in the Jetec, standard 10-32 stud package, while the 50MZ (50 watt) series uses the TO-3 package with either plug-in or solder-in features as



well as series interlock construction for protection against overvoltage on load. Both Zener regulator families are available with either anode or cathode connected to case for maximum circuit flexibility.

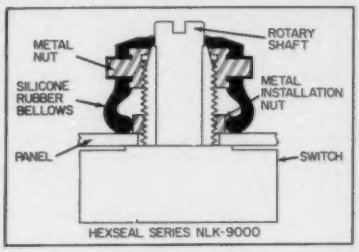
Motorola Inc., Phoenix, Ariz. (136)

(Continued on page 50)

High pressure shaft seal

A seal for locking type shafts has been introduced by Automatic & Precision Manufacturing Co. The sealing devices are designated Hexseal, series NLK-9000. They are intended for use with Allen Bradley potentiometers, Type J, and similar adjust-and-lock components.

The basic design is a one-piece silicone rubber bellows molded to a metal nut. The bellows seals against the panel and an inwardly protruding O-rib seals against the rotary shaft. Series NLK-9000 are also available to fit all standard thread and shaft sizes. The materials used are unaffected by salt water, acids and ozone. They are useful over the temperature range of —160 F to 500 F.



A. T. R. Armstrong Ltd., Toronto. (137)

Remotely operated weather instruments

The Texas Electronics Weatherminder provides information on barometric pressure, wind velocity, wind direction and temperature. Seventy-five feet of plastic insulated coaxial conductor (longer lengths may be ordered) connect the recording instruments to the indicator console. Selsyn units with gold slip rings and platinum contact brushes are used in both the anemometer and the wind direction transmitter.

The exposed roof unit is manufactured of gold anodized aluminum to resist corrosion and provide light construction. The console is hand-rubbed walnut measuring 19x8x7 in. The system operates on 110 vac, with 6 volts used in the remote indicators.

Alex L. Clark Ltd., Toronto. (138)

Time sequence control

Completely automatic in operation, the Time Sequence Control eliminates operator errors and may be set to control three separate timing operations simultaneously. Operating on three channels, the instrument handles any time up to 130 seconds on the selected channels. Other models may be specified to meet special testing requirements. These may be equipped with an automatic reject alarm or a measuring meter relay.

Mid-Eastern Electronics Inc., Springfield, N.J. (139)

Advertisers' Index

Professional engineers establish education foundation

A multi-purpose education foundation has been established by the 17,000-member Association of Professional Engineers of Ontario.

Known as the Ontario Professional Engineers' Foundation for Education, one of its basic purposes will be to provide financial assistance to members of the teaching profession and persons proposing to become teachers who will specialize in mathematics and science subjects.

When making the announcement C. T. Carson, P.Eng., Association president, pointed out that "there is a dangerous shortage of qualified maths and science teachers in this country at present." He added that the Association hopes the establishment of such a foundation will encourage an increasing interest in these subjects by teachers.

The foundation will also promote and assist the post-graduate training and education of professional engineers to enable them to achieve higher professional qualifications.

The foundation will accept contributions, gifts, bequests and legacies, with gifts being deductible for income tax purposes.

The foundation was approved by the Association's Executive Council as a means of augmenting the present scholarship program undertaken by the engineering body.

The newly-established education foundation will be administered by the Association's permanent staff which is headed by Col. T. M. Medland, executive director.

REUTERS INSTALLS NEW TELEPRINTERS

First major installation has been made of the new high-speed model 75 teleprinter manufactured by Creed & Co., England.

Made for Reuters Ltd., the world-famous news agency, the installation comprises 200 of the new machines which are being used in their London news distribution service operating on a 24-hour 100-words-per-minute broadcast basis.

Hub of the new network is the London headquarters of Reuters at 85 Fleet Street where incoming 'raw' news and despatches from correspondents throughout the world are sorted, edited and then distributed, by automatic tape transmission, to clients and subscribers equipped with the new printers. These subscribers include all the major national newspapers, the London offices of certain provincial and Scottish newspapers, the British Broadcasting Corporation and the Press Association, the latter retransmitting edited items to over 100 subscriber newspapers throughout the United Kingdom equipped with other models of Creed Teleprinter.

Hartz to address Toronto IRE

The next meeting of the Institute of Radio Engineers, Toronto Section, will be held on Monday evening, December 8, at 8.30 p.m. in Room 252 of the Mechanical Building, University of Toronto. Dr. T. R. Hartz, Defence Research Board, will present "Measurements on Solar Corpuscles and their Relation to Ionospheric Storms."

Dr. Donald A. MacRae, Professor of Astronomy at the David-Dunlap Observatory, University of Toronto, will speak at the 6.00 p.m. Supper Meeting at Hart House. He will give an illustrated talk on his impressions of Russia received while attending the International Astronomical Union Assembly in Moscow during August 1958.

Commonwealth telecommunications

Following agreement in principle at the Montreal Trade and Economic Conference, there is now the promise that the world's first trans-oceanic telephone cable opened in 1956 between Britain, Canada and the United States (to be supplemented by the new cable between Britain and Canada due for completion in 1961) will be but the first part of a round-the-world telephone cable system linking all parts of the Commonwealth.

Technical experts of the Commonwealth Telecommunications Board who met in London earlier in the year estimated that the total length of the round-the-world cable would be about 27,000 nautical miles, or nearly 30,000 nautical miles if the transatlantic crossing is included. The construction cost was estimated at $240 million including the transatlantic cables.

COMING EVENTS

December

3-5 Second National Symposium on Global Communications. St. Petersburg, Fla.

3-5 Eastern Joint Computer Conference, Philadelphia, Pa.

4-5 IRE-PGVC Annual Meeting. Chicago, Ill.

9-11 Mid-America Electronics Convention. Kansas City, Mo.

January 1959

12-13 Reliability & Quality Control National Symposium. Philadelphia, Pa.

February

1-6 AIEE Winter General Meeting. Statler Hotel, New York.

12-13 Solid-State Circuits Conference. Philadelphia, Pa.

March

2-6 Western Joint Computer Conference. San Francisco, Calif.

19-24 Second International Exhibition of Electronic Components. Paris, France.

23-26 Radio Engineering Show and IRE National Convention. New York.

April

5-10 Fifth Nuclear Congress. Cleveland, Ohio.

16-18 Southwestern IRE Regional Conference & Electronics Show. Dallas, Tex.

May

4-6 National Aeronautical and Navigational Electronics Conference. Dayton, Ohio.

6-8 1959 Electronic Components Conference. Philadelphia, Pa.

What's ahead for electronics?

There have been some very significant developments in the Canadian electronics industry during 1958. Just how significant have these been, however, and what effects will they have on the industry in 1959?

To get answers to some of these questions, Canadian Electronics Engineering has been compiling statistics and consulting with many people both in and near the industry.

The results will appear as the main editorial feature of CEE's Industry Review and Forecast issue in January.

The issue will also include technical articles and full regular departmental news coverage.

Free service for our readers

Keep your reference shelf up to date this easy way. All advertisements, new products and literature in this issue have a key number. For more information

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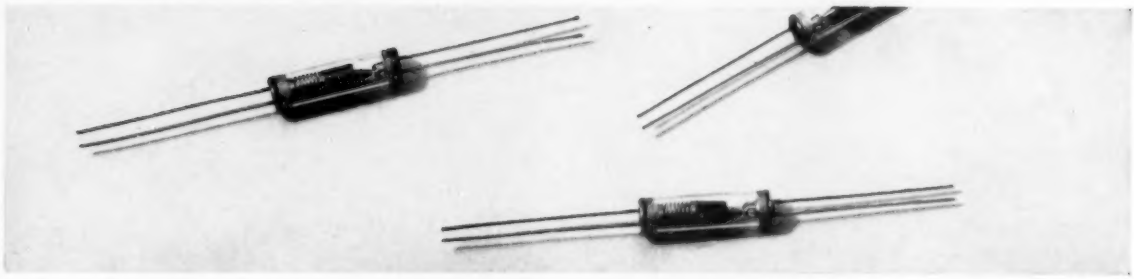
HUGHES THERMAL RELAYS



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Hughes now makes commercially available a completely reliable single action switch. Used in the Falcon, field proven as a reliable missile, this Hughes relay is engineered to meet the most exacting of requirements.

With unusual speed of action, firing signal triggers the release of constrained contact... contact closes upon fixed contact point... switch circuit becomes permanently closed.

In a typical application, 3.0 volts DC applied to a firing circuit of 1.2 ohms fire within 0.3 seconds.

For additional information please write: Hughes Products Marketing Department, International Airport Station, Los Angeles 45, California.

SPECIFICATIONS

MECHANICAL—**Body Size:** Maximum diameter 0.252"; length .920". Total weight: Less than 0.1 oz.

ELECTRICAL—**Before Firing:** Insulation resistance is greater than 200 megohms. Minimum breakdown voltage 600 volts.

Firing: 2 volts minimum required. Actual voltage dependent upon closing time desired.

After Firing: Circuit resistance less than 0.3 ohm.

ALTITUDE—Any.

OPERATING TEMPERATURE: −55°C to +125°C.

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Eimac Ceramic Tetrodes from 325 to 11,000 watts

Generating a clean SSB signal is one thing . . . amplifying it to the desired power level with stability and no distortion is another. A modern Class AB_1 final amplifier designed around an Eimac ceramic-metal tetrode is the ideal answer to the problem. The Eimac ceramic linear amplifier tubes shown above — the 4CX250B, the 4CX300A, the 4CX1000A and the 4CX5000A — offer the high power gain, low distortion and high stability that is needed for Class AB_1 operation. Each has performance-proved reserve ability to handle the high peak powers encountered in SSB operation. Efficient integral-finned anode cooler and Eimac Air System Sockets keep blower requirements at a minimum and allow compact equipment design. And, all four incorporate the many advantages of Eimac ceramic-metal design, which assures compact, rugged, high performance tubes.

The high performance and reliability of Eimac ceramic tetrodes make them the logical starting point in the design of compact, efficient single sideband equipment.

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CLASS AB_1 SSB OPERATION

	4CX250B	4CX300A	4CX1000A	4CX5000A
Plate Voltage	2000 v	2500 v	3000 v	7500 v
Driving Power	0 w	0 w	0 w	0 w
Peak Envelope Power. .	325 w	400 w	1680 w	11,000 w

C51